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An Address.[1]

MEDICAL EDUCATION IN PSYCHIATRY IN AUSTRALIA.

By W. S. DAWSON,
Sydney.

WHILE I am deeply conscious and appreciative of the honour done me by the invitation to deliver an address to you, I also feel intensely diffident about discussing anything which has to do with the medical curriculum, a subject which is so contentious that nothing that I can suggest can possibly find general approval. At the best I may at least hope to provoke discussion, and at the worst it will be said that my remarks are only what was to be expected from a psychiatrist.

Psychiatry has had a place in the medical curriculum for barely a century. John Conolly, later to become known as one of the pioneers of the humanitarian treatment of the insane, held the chair of the practice of medicine at University College, London, 1827 to 1831, and offered to give lectures on mental disorders and clinical instruction in a mental hospital, but the council of the college rejected his proposal. A few years later, however, he decided to devote his life to the care of the insane, and in 1839 was appointed resident physician at Hanwell Asylum, where in 1842 he began a course of clinical teaching in the wards. While he was still a professor of medicine he had written ("Indications of Insanity", London, 1830):

> The interests of the public greatly require that medical men, to whom alone the insane can ever be properly trusted, should have opportunities of studying the various forms of insanity, and preparing themselves for its treatment, in the same manner in which they prepare themselves for the treatment of other disorders. They have at present no such opportunity.

These words of Conolly unfortunately still carry a message, for, while the status of psychiatry in the medical family has improved, the term Cinderella may still be applied in some quarters with justification. As Sir James Clark wrote in 1869 ("Memoir of John Conolly"), referring to the small numbers of students who availed themselves of clinical instruction in the mental hospitals: "So it will continue to be till insanity is made a subject of examination for a medical degree." Dr. Gull ("Memoir of John Conolly") wrote of Conolly's teaching in 1842:

> I had the advantage of attending the clinical lectures given by Dr. Conolly at the Hanwell Asylum, and I retain the most vivid and pleasant remembrance of them. Two students were nominated from each of the metropolitan hospitals to form this clinical class. We assembled at Hanwell about noon once a week. We then made a visit through the wards in company with Dr. Conolly and the medical officers of the asylum, receiving some words of instruction upon the cases in general, our attention being especially directed to particular patients. This occupied probably nearly two hours: I believe sometimes more. We thus from week to week saw almost every phase of mental disorder, from acute mania to general paralysis and dementia. We also saw the application of the system of non-restraint, then on its trial, directed by that kind and calm philosophic temper so very conspicuous in Dr. Conolly.

The visits to mental hospitals initiated by Conolly continue to be the only form of instruction in mental disorders required by some British medical schools.

Thomas Laycock, who just a century ago was professor of medicine in the University of Edinburgh and lecturer in medical psychology and mental diseases, insisted that

[1] The inaugural address of the Australasian Association of Psychiatrists, delivered at Melbourne on October 16, 1946.

a thorough knowledge of medical psychology is as necessary for success in education as in the practice of medicine, the object of medical psychology being "living man; that is, as he exists on earth and not as a disembodied spirit or as thinking, feeling and willing independently of his organization. . . . Medical psychology as I propose to teach it examines mental states in correlation with the vital states with which they are necessarily coincident in the living man, and without which they cannot take place". He developed his ideas further in his work "Mind and Brain" (1860), in which he wrote: "In matters of daily labour every man is concerned to know what will keep his faculties in vigour, his memory good, his thoughts clear, his mind at ease", and went on to urge that knowledge of mental science including "the reciprocal influence of body and mind" is essential to parents, teachers, employers, naval and military officers, the legal profession, the governors of penal institutions and ministers of religion. In his emphasis on the study of living man Laycock surely anticipated the kind of psychology which only many decades after his time began to find recognition in non-medical circles. And Laycock's successors amongst the teachers of psychiatry in Edinburgh, notably Thomas Clouston, who was appointed lecturer in mental diseases in 1879, have done much to develop and propagate knowledge concerning healthy living and the preservation of mental efficiency and emotional balance—that body of knowledge and principles which is today subsumed under the heading of mental hygiene. One can only regret that amongst the foundations of training of such learned professions as teaching, the law and the church, some acquaintance with biology and an adequate study of human behaviour are usually lacking. As the late Sir Farquhar Buzzard, Regius Professor of Medicine in the University of Oxford, observed:

> Until all men and women reach adult life equipped with some sound, although elementary, knowledge of the structure and functions of their own bodies and minds, until they are endowed with some sense of responsibility to themselves and to their progeny, little practical use can be made of the rich harvest of scientific facts and laws which is now being reaped.

In Australia it would appear that the University of Sydney took the lead in appointing a regular lecturer in mental disorders. Frederick Norton Manning, doctor of medicine of the University of Saint Andrews, came out as surgeon on the brig Her Majesty's ship *Esk*. In 1867, whilst his ship was in Sydney Harbour, Manning visited the asylums, as they were then called, at Parramatta and at Tarban Creek, later known as Gladesville, and was soon after appointed medical superintendent at the latter institution by the Parkes Government. He was then sent on a visit to Europe and America. On his return he presented a report, printed in Sydney in 1868. With the experience which he had gained in the course of his visit overseas, Manning set about instituting structural and administrative reforms in the Parramatta and Gladesville Hospitals. In 1868 he opened a reception house at Darlinghurst, described by one of his contemporaries as a "monument to the designer's liberality of thought and to his care for the insane". He was also largely responsible for the design of Callan Park and Kenmore Hospitals. A *Lunacy Act* came into force in 1878 and Manning became inspector-general of the insane and visitor in lunacy to the Supreme Court. In 1898 he resigned from the public service to enter into consulting practice and died in 1903 at the age of sixty-four. He had held many public positions, not all of which were connected with his profession, and in 1907 the proceeds of a public subscription collected to perpetuate his memory were handed to the University of Sydney with a view to endowing a prize in psychological medicine. Regulations concerning the prize were drawn up in 1931, since when the Norton Manning Prize has been awarded for proficiency in the fifth degree examination in psychiatry, including the writing of a commentary on a selected case.

Norton Manning was the first lecturer in psychological medicine in the University of Sydney, from 1886 to 1889, and was succeeded by Chisholm Ross, 1890 to 1907, who in turn was followed by Froude Flashman, 1908 to 1914, and Andrew Davidson, 1914 to 1922, when a chair of psychiatry was established from which the late Sir John Macpherson retired in 1926. In Adelaide Dr. William Lennox Cleland, medical superintendent of Parkside Mental Hospital, gave instruction to medical students some time after the Medical School was established in 1885, but the position of lecturer did not become official until the appointment of Dr. M. Downey in 1912. In Melbourne Dr. W. H. Barker and Dr. W. L. Mullen taught in the mental hospitals under their charge, during the early days of the Medical School. Dr. Beattie Smith carried on the example of his former teacher, Thomas Clouston, of Edinburgh, in spreading knowledge of the prevention and treatment of mental disorders not only to his students and colleagues, but also to the general public, and left an endowment for lectures to further these objects. The University of Melbourne has established a diploma in psychological medicine, but the teaching of psychiatry has not yet reached professorial status. A chair of medical psychology was established in the University of Queensland some years before the founding of the Medical School.

The task of these earlier teachers in our specialty was all the more responsible in that for the mass of the population there were no hospitals for early treatment, and without the active methods now available a policy of "wait and see" had more frequently to be adopted, a policy fraught with anxiety and a sense of frustration on the part of both physician and relatives, naturally reluctant to take the grave decision to remove the patient to a mental hospital under certificate. To some extent the provision of reception houses for temporary observation and care afforded relief to both the public and the medical profession, but there were still lacking the means for skilled treatment until the mental disorder came within the provisions of the *Lunacy Acts*. The psychiatrist of those days was the alienist, the specialist who dealt with the insane whose minds were alienated from themselves. Psychoneuroses, with the possible exception of hysteria and hypochondria, were scarcely official and respectable and psychosomatic medicine had not yet arrived. One should not forget that the medical superintendents of our mental hospitals have trained in their specialty many graduates who joined their staffs as raw apprentices, and later went out into general or special practice, having received the only post-graduate teaching in psychiatry available before the institution of diplomas in psychological medicine and the organization of courses by post-graduate committees.

The Medico-Psychological Association of Great Britain was founded in 1841 on the initiative of Dr. Samuel Hitch, superintendent of the Gloucester Asylum, and this body received its Royal Charter in 1926. Its publication, *The Asylum Journal*, first appeared in 1853, and *The Journal of Mental Science* in 1858, the name by which it continues to be known. Among the various objects put forward by the founders of the English association the "acquirement of a more extensive and more correct knowledge of insanity" was given a prominent place. Our knowledge in this and kindred branches of medicine has indeed become more extensive since those objects were formulated a century ago, but to an extenf which is sometimes bewildering. Scientists in many fields are encumbered by a plethora of unrelated observations and insufficiently attested theories. One of the reasons commonly advanced for the neglect of psychiatry and its failure to attract both students and graduates to its practice is that it is concerned with the study and treatment of a hypothetical mind about which we know next to nothing. Like the proverbial philosopher who was said to spend his time searching for non-existent black hats in dark rooms, we psychiatrists also have the reputation of delving for we know not what in minds which superficially appear to be quite vacant. But the Freudians at least cannot be accused of having fished in vain.

But before proceeding to a consideration of the present status of psychiatry and advancing reasons why it should receive more attention, it is of interest to recall a few of the stages in the development of the principles which

govern the practice of this specialty today. It would seem that two somewhat differing standpoints were in evidence up to quite recent years derived from institutional care of the insane on the one hand, and on the other emerging from extramural practice.

Institutional psychiatry may be said to have broken its ties with mediæval superstition with the abandonment of such "active" methods of treatment as phlebotomy, cupping and purgation, carried out to a degree calculated to reduce the most violent maniac to a state of helpless exhaustion, methods which though ostensibly directed at so-called sthenic states, and not applied solely to the insane, can have been prompted only by a survival of the notion that there was something materially or spiritually bad in the patient which called for expulsion before he could hope for cure.

Humanitarian reforms in the treatment of the insane were adopted as a definite policy from the end of 1792 when Philippe Pinel cast off the fetters from a number of his patients in the Salpêtrière. The York Retreat was opened by the Society of Friends in 1796 following a public outcry at abuses in the neighbouring asylum. Here and there on the continent of Europe and in America Pinel's example was followed, but reform was more rapid and general in England under the leadership of Gardiner Hill, William Tuke and John Conolly. Though asylum physicians were not neglectful in applying developments in general medicine to their own clinical problems and Bayle's "Thesis" on the morbid appearances in the brains of patients who had suffered from a peculiar form of paralysis with mental symptoms, presented at Paris in 1822, stimulated clinical and post-mortem inquiry, advances continued rather in the improvement of board and lodging in mental institutions and in the evolution of *régimes*, which allowed of greater liberty within the limits prescribed by the lunacy laws with exercise and occupation designed as much for the patients' benefit as for the convenience of the management. So for a century treatment continued to be moral rather than physical. Statistics of insanity, while emphasizing congenital predisposition as the most common factor, referred also to sexual excess, disappointed affections and "excitement connected with religious hopes, fears and speculations" (Thurnam[1]). In general, English psychiatry has been distinguished by its humanity and common sense, with an essentially eclectic outlook, applying what promises to be useful and beneficial from whatever source. Interest has been centred in the patient rather than on any particular system. English psychiatrists have been satisfied to remain good physicians; they have seldom aspired to be metaphysicians.

The Neurological Approach.

Although Hughlings Jackson (1834 to 1911) is more generally regarded as the father of English neurology, he applied his principles of the evolution and dissolution of the nervous system to the phenomena of the insanities which he had studied in the Wakefield Asylum in his home county of Yorkshire. It is of interest to note that Jackson acknowledged a suggestion put forward by an asylum physician, Henry Munro, in 1851 that insanity, to use Munro's words, "results directly and entirely from excessive depression of the nervous centres of those higher faculties or partly in an indirect manner from nervous energy being abstracted to other parts which are in more violent exercise at the time". Munro had been impressed by Thomas Laycock's theory that dreams and delirium resulted from reflex action in the brain to stimuli derived from other parts of the body. From this basis and from a close observation of the symptoms and signs of epilepsy Jackson developed his conception of dissolution of higher centres with cessation of their functions and loss of control over lower functional levels and with release of activities normally held in check. Hence the reverie of fatigue, dreaming (it was Osler who said that most of us are insane for several hours during the night), delirium, the extravagant conduct of mania, and delusions. In a footnote to one of his papers Jackson wrote:[2] "Integration, a very important factor, is ignored by the current doctrine (of evolution). It is an exceedingly important factor." So important indeed that, as Sherrington has shown by his experiments, it is the essential function of the nervous system. Similar conceptions were being applied to psychology by Armand Ribaud in his work on personality (1885) where he described the self as a coordination. Jackson was interested mainly in the mechanism of the nervous system, but he could not refrain from speculation about the mind-body relationship, and favoured the idea of concomitance. Among the factors which he put forward in the causation of insanities, he mentioned, first, the different depths of dissolution of the highest centres, or to borrow the concepts of various schools of psychopathology, the degrees of regression towards the infantile and primitive, the departure from the reality principle, the reduced capacity for contact with the environment, material and social, and adaptation to it. Second, the different persons who have undergone the dissolution. Here Jackson called attention to the influence of age, education, state of intelligence, occupation and innate tendencies. Jackson maintained that a man did not inherit a tendency to insanity, but "a brain which will 'give out' more easily under unfavourable influences than the brain of the average man".

Jackson's third factor is the rate with which dissolution takes place. Consider the rapid dissolution in acute alcoholism in which may be observed what Henry Maudsley,[3] applying Jackson's principles, described as "the abstract and brief chronicle of insanity, going through its successive phases in a short period of time"; and on the other hand, the gradual and uneventful decline in the mentality of the senile dement. Finally, Jackson referred to the effects of local bodily states and of external circumstances on the symptomatology of mental disorders. Clearly bodily states and tensions and imbalance in the endocrine and autonomic systems have their reflexion in mood and temperament and ultimately in thought. Like the old problem concerning the priority of the hen or the egg, we are often in doubt whether internal and constitutional or external, environmental conditions are to be held responsible for instability at any level in the nervous system. Much of our therapy is directed towards helping individuals, the efficiency of whose highest centres is more or less constantly lowered by the urgency of emotional stimuli. When passion rises up, reason is driven out. In his description of the insanities as dissolutions or reversals of evolution Jackson attempted to demonstrate a common basis for both physical and so-called functional disorders, the latter being disturbances at the highest level of activity or response, the level at which the nervous system may be regarded as still in a process of development, at which reactions have not become fixed and transmissible to future generations. It is true that the examples from mental disorders which Jackson put forward in support of his theories, were mainly from syndromes with an organic basis or ætiology, for example, dementia and toxic delirium. He referred hardly at all to the psychoneuroses. I think that without doing violence to the facts, we may regard psychoneuroses as well as insanities as states of dissolution, such symptoms as difficulty in concentrating and in registering and recalling memories being negative, evidence of reduced activity of the highest level: fears, obsessions, emotional crises and hysterical automatisms coming within the category of release phenomena, a return more or less to personal or even to racially infantile modes of reaction. Jackson reminded us, too, that, to quote his words: "Our concern as medical men is with the body. If there be such a thing as disease of mind we can do nothing for it. Negative and positive mental symptoms are for us only signs of what is not going on, or of what is going on wrong, in the highest sensori-motor centres." We may well ask ourselves do we in fact treat mind any more than the general physician treats respiration or circulation, apart from the physical, structural mechanisms which subserve these functions?

Some words that John Conolly[4] wrote during his tenure of the Chair of Medicine in London are as worthy of consideration today as they were in 1830.

"Improved habits of life", wrote Conolly, "and an enlightened system of medicine are daily decreasing the number of the disorders which primarily affect the corporeal fabric; but as communities advance in zeal for intellectual acquirement, in refinement, and in all the means and appliances of luxury, the human frame, not destined for perfection, is seen to become exposed to the operation of new causes of disorder; and, in a particular manner, the susceptibility of its nervous structure becomes increased as regards all ordinary influences. From hence arise new irritations, various in their character and intensity, but all, by duration or excess, passing into disorder and disease; disturbing the actions of the body and mind, and altering even the physical characters of the organs in which those actions are performed."

After referring to the excitements and anxieties of highly cultivated communities he proceeds: "He neglects half the history of half the cases concerning which he is consulted, if he overlooks the inward influence of the restless mind. He is unprepared for the duties required by the age in which he practises, if he forgets the slow processes of change which the advance of man, from the savage state to a state of the utmost refinement, has effected or is effecting." In a footnote there is a reference to increase in the number of the insane and the "increased prevalence of what are called *Nervous* disorders".

The statistics of the New South Wales Department of Mental Hospitals do not show any increase, but rather a fall in the number of the insane, that is, certified persons, in proportion to the general population, especially during the past thirty years. But during this period there has been a great extension of facilities for treatment, so-called early treatment, of mental disorders at stages before certification under the lunacy laws has become unavoidable. And whether nervous disorders are become more numerous or whether they are being more frequently recognized, is a matter of opinion. Osler said that one feature is possessed by man which he does not share with other animals, and that is his craving for medicine. And what medicines are more in demand than aceto-salicylates, barbiturates and alcohol? Far be it from us to aim to create a race of: "Finished and finite clods, untroubled by a spark" (Browning).

The racing thoroughbred has more of a nervous temperament than the horse harnessed to the plough. But has not the capacity of medical science to alleviate physical disease and preserve life outrun the means of controlling heredity and improving constitution? How much of our treatment, especially in the realm of psychiatry, is designed to make life easier for those by nature unfitted to stand the demands of their social environments? That change and development continue, we must believe. "The brain", said Sherrington,[5] "is primarily a manager of muscle, fitting the motor apparatus much as a key fits its lock." To the question "Who turns the key?" Sherrington replies: "The outside world. The dominant partner in the driving of the brain is the outside world in commerce with the animal." And among the stimuli from the outside world we may count as most important and most insistent for the "centres in which evolution is most actively going on, the least automatic or most imperfectly reflex" (Jackson), the influences of culture and social systems. It is at this level of our nervous and mental organization that adaptations break down and mental disorder becomes manifest. Progress in those qualities which distinguish mankind from the brutes can continue only at the expense of those who must drop out of the race. I do not know what are the accepted views concerning evolution, but I hold to the faith that development goes on, that evolution is creative and that breakdowns in adaptation in some members of the human family are no more evidence of a general deterioration of the stock than wars and civil commotion here and there amongst different social groups are to be taken as indications that social development has its brakes jammed on or has even reversed its gears.

Jackson made no attempt to incorporate his principles into classifications of mental disorders, but he at least laid the foundations for their systematic study, by bringing them into line with other disorders of the cerebro-spinal system. The student will more readily grasp the subject of mind and its aberrations if he approaches it as a higher integration of functions, and not as something completely detached from general medicine and neurology.

Descriptive Psychiatry.

From the beginning of the nineteenth century there was steady progress in observations on mental disorders. Pinel's "Treatise" (1805) contained a simple classification of mania with delusions, melancholia with delusions, melancholia with suicidal impulses, dementia and idiocy, which may be compared with the thirty or more groupings recognized today.

Descriptive psychiatry reached its greatest refinement with the work of E. Kraepelin (1856 to 1926), who applied the current principles of general medicine to mental disorders which he classified in terms of cause, symptomatology, pathology (if any), course and outcome. His system introduced order into somewhat chaotic and haphazard groupings, the major contribution being his clear-cut and perhaps over-dogmatic formulation of *dementia præcox*, the manic-depressive psychoses and paranoia, the so-called functional psychoses which still lack an undisputed physical ætiology or demonstrable pathology. No doubt Kraepelin's system has proved to be over-elaborate, many of the clinical conditions which he regarded as varieties proving to be stages in the course of a simple disorder. Not all those who have adopted Kraepelin's system, in which he at least left us a basis for future work, have acknowledged his efforts to determine the personality background of the functional psychoses and psychopathic states and the influence of age upon their form and course. Kraepelin's work will remain as a landmark in the development of psychiatry essentially because his conclusions rest upon a solid foundation of careful observations.

So far I have sketched the developments in psychiatry which have been based essentially on observations made on patients in institutions, displaying the more pronounced deviations from normal behaviour which go by the name of psychoses and insanities. The essential feature of insanity is a breakdown in the social sense—as Henry Maudsley put it "by insanity of mind is meant such derangement of the leading functions of thought, feeling and will, together or separately as disable the person from thinking the thoughts, feeling the feelings and doing the duties of the social body in, for and by which he lives". Hence emphasis on current teaching on mental disorders was on the management of the insane, the use of chemical methods of restraint, protection of the patient from himself, and of society from the patient. Little or no direct appeal could be made to the patient, and psychotherapy as we understand the word was inapplicable. That the patient's motives were perverse was patent enough, but the tortuous channels of his mental processes were not accessible to ordinary inquiry. Hence it came about that light from a rather different source was thrown on to the recesses of the morbid mind.

Psychotherapy.

The story of mental healing practised according to a definite method goes back to the time of the Æsculapian cult as followed in the temple of Epidaurus. Here the diseased in body and mind gathered to undergo the procedure of "*incubatio*", the mystic ritual sleep within the precincts of the temple when it was believed that Æsculapius appeared in the patients' dreams and gave directions. Further instructions were received from the priests, who also supervised the suppliant's diet, exercise and recreation. The Æsculapian method would appear to have combined the main features of a hydropathic establishment with that of a religious retreat. After Greek enlightenment followed the Dark Ages and centuries of superstition, persecution of hysterical women as witches, and the subjection of the insane to such procedures as that followed at Saint Fillan's Wall in Perthshire, where according to the record of an observer as late as the end of the eighteenth century "the patients are conducted by their friends, who first perform the ceremony of passing

with them thrice round a neighbouring cairn; on this cairn they then deposit a simple offering of clothes. . . . The patient is then thrice immersed in the sacred pool; after the immersion he is bound hand and foot, and left for the night in a chapel which stands near. If he is still bound, his cure remains doubtful. It sometimes happens that death relieves him during his confinement from the troubles of life".

But a few hospitals for the insane were established by religious orders such as Bethlem (1247). The majority of the insane were allowed to wander about untended like those "lunatik lollards" mentioned in Piers the Plowman:

Moneyless they walke
With a good will, witless, many wyde contreyes
Ryght as Peter dade and Paul, save that they preche not.

But to return to psychotherapy. In 1765 Franz Anton Mesmer graduated in medicine at the University of Vienna with a thesis "*De Planitarum Influxu*" and a few years later began to treat patients as he thought by means of electricity and magnetism. His technique later developed into a kind of ritual with patients sitting round a tub, the famous "baquet" filled with iron filings from which protruded iron rods. While the patients grasped the rods Mesmer, dressed in his purple robes, moved slowly round to the strains of soft music, making passes with his hands. His success was sufficient to arouse the jealousy of his more conservative medical colleagues, and he left his native country for Paris, where also his cures called on his head the displeasure of the authorities. A Commission of the Academy of France, which included Lavoisier, Dr. Guillotin and Benjamin Franklin, concluded that "imagination" played a large part in Mesmer's methods, and that while cures must be accepted, animal magnetism might have undesirable moral effects. Mesmerism became discredited, but not long before his death in 1815 he published a work "Mesmerism or the System of Reciprocal Influences". Subsequent practitioners of Mesmer's methods discovered that rods were unnecessary and that trances could be induced quite simply without any loss of therapeutic power. John Elliotson, who followed John Conolly in the Chair of the Principles and Practice of Physic in the University of London, was a keen exponent of hypnotism and also of the theories of Gall and Spurzheim concerning the localization of faculties in the brain. He was forced to resign his chair and his paper on "Numerous Cases of Surgical Operations without Pain in the Mesmeric State" (1843) damaged further his reputation amongst his colleagues. In the same year there appeared James Braid's "Neurohypnology", a cautious and critical study in which he firmly opposed the idea that mesmerism acted through any physical agency and coined the word hypnotism to cover the phenomenon of sleep induced by suggestion. From this stage there developed the psychological investigation of the curious behaviour which could be induced by susceptible individuals by means of hypnotism.

Hypnotic suggestion continued to be used by Morton Prince and others in the investigation of cases of so-called multiple personality. It is an open question whether the Sally Beauchamps, Mary Reynolds and Irenes who provided such dramatic episodes were not fortunate in coming under the notice of observers who were themselves highly suggestible. With greater understanding of the power of suggestion it would appear that the medical profession of our day is not only more careful of conveying unwise suggestions, but also has a keen awareness of the hysteric's tendency to imposture. Hypotism as a therapeutic agent has largely fallen into disuse. But mass suggestion in the form of subtly worded and discriminatingly conveyed propaganda has become a powerful force for good and evil.

Nostrums retain their appeal and their potency for a not inconsiderable section of the population. The vision of a golden age and specious promises dull the critical faculties and excite the infantile longings for effortless security. As a writer in *Punch* put it some years ago:

The World wants dope,
Simple, convincing and replete with hope.

Crude suggestion by means of the well-advertised elixir has its therapeutic value no less than an emphatic pronouncement by a physician who may have had no special training or even interest in psychological medicine. Unfortunately our appreciation of personalities is still too uncertain to enable us to use suggestion by any other than crude, empirical methods. We are still very far from selecting and presenting psychotherapeutic stimuli with the control and precision of a worker in Pavlov's laboratory.

Hypnotic suggestion was used by Charcot, whose "circus" of highly suggestible subjects both amazed and amused students of nervous disease. Amongst those who attended Charcot's clinic was Sigmund Freud, who in turn used hypnotism, and after observing a recall of distressing memories in a patient developed his technique of bringing repressed material to full consciousness by psychoanalysis. I do not think that time can be spared to trouble our medical students with the intricacies of psychoanalytical doctrine. That there is much wishful thinking in our everyday converse; that urges from below, call them original sin, instinct, or expressions of the Freudian "Id" as you will, all too often break through the thin veneer of recent culture; that each one of us retains more or less of the infantile—these themes so discordantly performed by the Freud-Jung-Adler trio now find general acceptance.

We are very slightly changed
From the semi-ape who ranged
India's prehistoric days.

—KIPLING.

Perhaps less notice might have been taken of the theory of psychoanalysis had a less novel and fanciful terminology been adopted and had the various exponents of that school attempted to preserve some contact with developments in other branches of biology, instead of adopting an exclusive esoteric attitude. Yet Freud[6] did say: "The edifice of psychoanalytic doctrine which we have erected is in reality but a superstructure which will have to be set on its organic foundation at some time or other; but the foundation is still unknown to us."

To claim success by any one method of treatment as has been done by exponents of different varieties of psychotherapy is surely to expose a mental blank, a lacunar amnesia, for the patients who have failed to respond. Suggestion, with or without hypnosis, persuasion, reeducation and finally Freudian psychoanalysis have all had their exclusive practitioners. No little harm has been done through the creation of confusion and disappointment by the uncritical popularizing of psychology and psychotherapy. A patient coming to one of our psychiatric outpatient departments, after seeing depicted on the screen a glamorized cure of mental ills, may well wonder if the psychiatrist knows his business. Unfortunately there is as yet far more art than science in our methods. The doctor-patient relationship eludes precise definition and the good bedside manner may be developed almost unconsciously, but can scarcely be taught. As far as our students are concerned, it will be sufficient if they learn to take a reasonably full history on psychiatric lines, one which will cover the main symptoms, their temporal relationships and associations with special experiences, and enough of the life story to give an indication of the main features of the personality, especially as regards temperament and adaptability. But Plato has already outlined the procedure ("Laws"): "But the physician enters into discussion with his patient and is at once getting information and also instructing him: at last, when he has brought the patient more and more under his persuasive influence and set him on the road to health, he attempts to effect a cure."

Psychobiology.

No discussion about current viewpoints in psychiatry would be complete without reference to the teaching of Adolf Meyer, lately retired from the chair of psychiatry at the Johns Hopkins Hospital, teaching which continues to exert a wide influence in the United States and also in other English-speaking countries. In psychobiology Meyer emphasizes the study of the individual as a whole reacting to the environment in which he lives and moves and has his being. Breaking away from the older faculty psychology

and avoiding the biased interpretations of the psychoanalytic schools, Meyer uses the method of simple observation and inquiry by question and answer, but an inquiry into the patient's performance and reactions under a wide range of conditions. Before approaching clinical psychiatry the student is expected to carry out a detailed personality study on himself and on one or two friends with whom he is on sufficiently confidential terms, according to a scheme which, though comprehensive, is sufficiently elastic in its application. When carried out conscientiously, this inquiry into personality does give the student insight into his own make-up, motives and reactions, maybe at some risk of setting in train unhealthy introspection, and also an understanding of his fellows. For how else do we judge of others but by comparison with ourselves? Further, this personality study is a training in the sort of history taking which is required in psychiatry. With the exception of studies of the behaviour of infants and young children, we have no body of observations which provide any standard of the reactions of the whole individual in health, though in a general way we pass judgement on our own and others' behaviour.

With regard to clinical psychiatry, Meyer's conception of reaction types—ergasias or workings—constitutes a departure from the more static idea of disease entities of the Kraepelinian system in the direction of a more dynamic interpretation. Meyer[7] has described his system as follows:

> The most fundamental departure from current tradition is the emphasis not on the question whether the patient presents one or other of a set of diseases, but rather on the question how many facts and conditions enter into the state of the patient, what reaction complexes are recognizable as relative entities, and what psychopathologic, cerebral, general, somatic, endocrine, toxic and infectious components. Let us get away from the dominant notion of classification of each patient as having just one exclusive disease.

With organic cases, including the grosser varieties of mental deficiency, we are on surer ground, even though many aspects of ætiology still await clarification. The difficulty is with the psychoneuroses and functional psychoses in which a complex of factors, personal and environmental, needs to be dissected out and evaluated. Quite rightly Meyer has emphasized the need to determine what kind of individual has developed the symptoms which call for treatment and in what environmental circumstances. Treatment is directed accordingly to the improvement of physical health, the application of psychotherapy, and the mitigation of environmental stresses as seems indicated in each case. By an unprejudiced approach to the problems presented by each patient Meyer has done much to encourage therapeutic effort, in which social agencies and social workers may play no minor role.

Psychosomatic Medicine.

The term psychosomatic medicine is coming into such general currency that it is of some interest to trace its origin. For long enough there has been discussion as to the physical and psychological origin of mental disorders. By physical is meant presumably the presence of some lesion or demonstrable change in structure to which may be ascribed a corresponding impairment of function. The term psychological is less easily defined and has been used accordingly to cover a wide range of factors. When we receive a verbal communication and react to it with elation or despair we speak of a mental reaction to a psychological stimulus. Should the sequent emotional state be intense and prolonged it might be considered as morbid and calling for treatment. More correctly we should speak of situational rather than psychological. We find on inquiry that our patient shows no evidence of nervous instability until after he has been exposed to a set of circumstances, after which he shows the symptoms and signs which we regard as evidence of some variety of mental disorder. This problem of the relationship of body and mind which has so exercised the philosophers provoked a controversy amongst the German psychiatrists of a century ago, which crystallized into three schools, the somatic, psychosomatic and psychic. The somatic school held that there could be no mental disorder without some primary physical change in the brain or other organs. As Thomas Huxley put it, though he was referring to normal mental activity: "No psychosis without neurosis." The psychic school on the other hand taught that a deterioration of the moral sentiments was the essential cause of the insanities. The psychosomatics took up a position between the somatics and psychics. The term psychosomatic has therefore been in active use on the continent of Europe a century ago, but has recently been revived in the United States. In a British Medical Association Report (1941) psychosomatic medicine is defined as "the study of the inter-relations of the psychological and physiological aspects of all normal and abnormal bodily functions, thus integrating somatic therapy and psychotherapy". The general physician has not neglected the effects of mental states upon bodily functions.

As the late William Osler has told us so delightfully in his address "Backwoods Physiologist" (1902), William Beaumont seized the opportunity of observing the gastric functions of a certain Alexis St. Martin who had sustained a severe gunshot wound in the side resulting in a permanent gastric fistula. Beaumont published the results of his researches in 1833, and amongst many other observations recorded the effect of mental disturbance on secretion of gastric juices and on digestion. Since then there has been much experimental work, notably that of W. B. Cannon, on the association between mental and gastric activities.

Cannon has left the story of a patient of a refined and resistive type who came for investigation of her digestive functions. After a test meal there was found no free acid, but the test breakfast had remained undigested with most of the meal of the previous evening. The patient had spent a restless night in a state of acute anxiety and distress over the conduct of her husband who had used the visit to the city for his own gratification. The patient underwent another test following a reconciliation with her husband and the gastric functions then appeared quite normal.

Quite recently Wolf and Wolff[8] were able to repeat Beaumont's work, with the help of modern methods of investigation and record.

Their patient, a man of fifty-six years of age, had fed himself through an artificial opening into his stomach since the age of nine when his œsophagus had become occluded after drinking a scalding hot fluid. He was in good health and seldom had any digestive complaint. A collar of gastric mucous membrane protruded through the artificial opening in the skin. Amongst other observations, the movements of the stomach, its secretions, and the appearance of the mucosa were watched in relation to his emotional state. He was a man of a rather shy sensitive type and very conscientious. As he was employed in the observers' laboratory there was good opportunity of judging his personal qualities. The emotion-producing situations were all natural and fortuitous and not created specially for the purposes of experiment. One morning the patient was upset and fearful because he had mislaid some notes urgently required by one of the medical staff. The patient's general reactions were excessive, for he became pale and seemed on the verge of a collapse. His gastric mucosa was pale and there was a drop in acid production. A little later the missing papers were found, whereupon the patient and his stomach promptly regained their poise. On another occasion he was disappointed and depressed over failure in a business transaction. The gastric motility and secretion of acid were reduced. On the other hand, on another occasion when the patient expressed feelings of anxiety and resentment over a personal experience, motility and secretion were both increased, and the gastric mucosa became red and engorged. He also complained of heartburn and abdominal pain. The engorged mucosa became eroded easily through slight trauma, and repeated exposure to irritants such as mustard, and occasionally bleeding points appeared as a result of vigorous contractions of the muscular wall of the stomach. In the absence of free secretion of mucus these erosions tended to ulcerate. The authors conclude: "It appears likely then that the chain of events which begins with anxiety and conflict and their associated overactivity of the stomach and ends with hæmorrhage or perforation is that which is involved in the natural history of peptic ulcer in human beings."

It should be noted that the situations to which this man reacted with such intensity were neither unusual nor grave. He may fairly be said to have overreacted by average standards. His particular emotional formula included mainly gastric reactions. Others react with their cardiovascular or respiratory systems; or perhaps by some other section of the alimentary tract. Spasm of an internal viscus may prove to be an expression, or, shall we say, an accompaniment of conflict or frustration, and we may suppose that nervous impulses which should be expended in external action become deviated inwards.

In each of the three cases just mentioned there is reference to the temperaments of the patients, and in two instances external factors provided the trigger which set off the visceral reaction. The labile temperament, the environmental factor and the visceral-emotional formula constitute the typical triad of psychosomatic medicine. And how elegantly has Kipling expressed the bodily resonance to a mental attitude:

But he that is costive of soul toward his fellow,
Through the ways, and the works, and the woes of this life,
Him food shall not fatten, him drink shall not mellow;
And his innards shall brew him perpetual strife.

Psychiatrists will be well pleased if psychosomatically minded physicians will continue to deal with this common problem of the medical wards of general hospitals one which the general practitioner must often handle alone. But what a strangely paradoxical situation is developing when general physicians are becoming preoccupied with the influence of the mind over the body, while psychiatrists continue to develop their physical methods of treatment of mental disorders, the pyrexial therapy of neurosyphilis, insulin-coma and convulsion therapy, and to invoke the aid of the neurosurgeon to relieve nervous tension. These procedures have indeed infused a new spirit into our specialty, dispelling the legend of futility and pessimism which have been so long attached to our therapeutic efforts. But until the student is taught to appreciate his patient more as a whole and not just as the unfortunate possessor of one or more diseased organs, and indeed until from the very beginning of his study of the human organism he is helped to grasp more of the interrelations of the various structures and functions of the body, he will need constant reminder that a relationship exists between mental states and visceral reactions, which indeed a little introspection on his part will amply prove. And the multiplication of mechanical aids to diagnosis and the growth of more or less independent departments in the larger general hospitals, both make it harder for the student to correlate the different aspects of his training and tend to obscure the individuality of the patient.

Psychiatric Clinics.

War brings in its train not only the not unmixed blessings of advances in physical science, but also the enduring benefits of new and more effective methods of treatment. The sometimes illusory successes in the application of psychotherapy to the mental casualties of the first world war were directly responsible for improving the status of psychiatry and for providing more facilities for treatment outside the jurisdiction of the lunacy laws. I have used the term illusory, for the successes ascribed to psychotherapy might often more justly have been put down to the removal of the patient from environmental stresses unusual in their quality and intensity. The times were ripe for a more generous provision of facilities for early treatment both intramural and extramural. Outpatient departments for nervous and mental diseases already existed in the larger teaching general hospitals. But there were no beds available for those who could not afford a private hospital. Medical officers in the services had learned that cardiac symptoms were much more often functional than of organic origin, and there was a growing awareness of significance of these and other symptoms as expressions of nervous excitability and of their association with the emotional life of the patient. The need for conserving the health and efficiency of the fighting forces in two world wars, and in the second the greater urgency of keeping the whole manpower of the nation at the highest possible pitch, caused medical officers in the forces and in civilian practice in England to be faced with psychiatric problems for which they often felt themselves ill-equipped. It is not suggested that this was true of the majority of Australian graduates, but many English qualifying bodies still require a regrettably low standard of training in psychiatry. Some deficiencies in the medical curriculum were remedied by progressive steps taken after 1918, notably by the institution of post-graduate diplomas in psychological medicine. We may hope, and it is the foremost intention of this association to ensure, that our specialty shall be given a more important place in the medical curriculum. Hence it is indeed fitting that the teaching of psychiatry has been chosen by our committee as the first topic to be presented to our association. It is worthy of mention that the realization that the generously supported mental hygiene movement in the United States of America seemed likely to fail in attaining its aims by reason of insufficient medical training in psychiatry, led to an investigation in 1932 of the teaching of psychiatry in the medical schools of America, sponsored by the Commonwealth Fund, an investigation in which Dr. Ralph Noble took a leading part.

A psychopathic hospital was opened at Ann Arbor, Michigan, as part of the medical school in 1906. The Henry Phipps Psychiatric Clinic at the Johns Hopkins Hospital began its work in 1913 under the direction of Professor Adolf Meyer. The Maudsley Hospital, London, founded by Henry Maudsley's bequest, was completed in 1917 and was used as a military psychiatric clearing station until it reopened for its original civilian purposes in 1922. Jordanburn in Edinburgh was established some years later, a neuropsychiatric pavilion at the Royal Prince Alfred Hospital was opened in 1938 and the York Clinic at Guy's Hospital, London, in 1943. The vision of the late Dr. Eric Sinclair, Inspector-General of Mental Hospitals in New South Wales, caused him to obtain Broughton Hall for a psychiatric clinic, opened in 1921. I mention these details because of the important steps which they mark in the progress of psychiatry. Their existence is tangible evidence of the faith that something can after all be done for the nervous or mental patient, that early treatment is as sound a policy in this department of medicine as in any other, that a liaison with other branches of medicine is now justified and necessary. In Australia, where the psychiatrist is as it were a general practitioner in his specialty, we have been spared the keen and even bitter discussions between those whose professional experience has been largely extramural and with the "functionals", and those whose work lies with the graver and institutional cases. There was little community of interest between the psychotherapist and the institutional specialist, and the different classes of case with which each was accustomed to deal prompted uncompromising attitudes on the questions of psychogenesis and physiogenesis, and fostered the claims that psychoneuroses and psychoses were fundamentally different. But Freud at least knew differently, for he had fished in both waters and showed the narrowness of the border territory between sanity and insanity, with differences of a quantitative rather than a qualitative character. As the old North Country man put it: "All the world's queer except thee and me and sometimes I think thee's a bit mad."

Nothing has done more to broaden psychiatric views and to harmonize different standpoints than the establishment of clinics for early treatment, where the medical psychotherapist and the psychiatrist meet on common ground and each makes his contribution to treatment.

Undergraduate Education in Psychiatry.

Undergraduate education in psychiatry has recently been considered by an authoritative committee of the Royal College of Physicians, London. It is suggested that a psychiatrist should take part in a short orientation course given at the outset of training in the medical school with

a view to giving the student a general idea of the nature and objects of the curriculum.

Psychology.—From twelve to twenty lectures in psychology should be given towards the end of the second pre-clinical year, being thus regarded as complementary to the course in physiology. The committee expresses a hope that teachers of biology, genetics, social medicine and physiology would combine to indicate the psychological aspects of their respective subjects. The following topics are mentioned as being of special value in the course on psychology to be divided between the psychiatrist and the psychologist: The psychology of development, childhood, adolescence, senescence. Social relationships, including family and industrial relationships. Estimation of intelligence and special, including vocational, aptitudes. Selection and training. Thinking. Memory. Learning. Fatigue. Emotion. Temperament. Character.

The committee is of opinion that conducted visits to schools, factories and courts might suitably be made with a view to familiarizing the student with the psychological problems which come to notice in such organizations.

The psychiatrist should participate in the introductory course on clinical methods given at the outset of the clinical stage in the medical curriculum. Psychiatric case-taking and examination should be illustrated by cases from both the psychiatric and the general medical and surgical departments of the hospital. This phase of instruction in psychiatry would be covered in not less than six sessions.

The Systematic Course in Psychiatry.—The committee lays stress on the need for more practical training in psychiatry. To quote from the report:

> The student should have the same opportunities of taking histories and examining patients for himself that he gets in other departments of medicine; he should see a due proportion of less severely affected patients, and he should have the social aspects of mental illness in all its forms, including neuroses, impressed upon him.

The student should spend three months as clerk to the psychiatric department of the teaching hospital, attending both in-patients and out-patients and keeping case records of at least twenty-five patients. It is not suggested, however, that he should devote the whole of his time to psychiatry during this period of three months. Other practical experience in psychiatry would be gained during the clinical period of the curriculum by attendance at demonstrations and meetings in the department, in admission wards in mental hospitals and institutions for mental defectives and at child guidance clinics. A short period of residence in a mental hospital and a few visits to homes under the supervision of a psychiatric social worker are also recommended.

The committee does not regard formal lectures as essential, provided that the general field of psychiatry and mental deficiency is covered in discussions and demonstrations. About fifty sessions would be needed, at least six of which should be devoted to the subject of mental deficiency.

Finally the committee recommends that the student should be examined in psychology (class examination or by question in the physiology paper) and that he should sit for a written, oral and preferably also clinical examination in psychiatry.

The recommendations of the committee have been summarized as follows in its report:[9]

> 1. Every teaching medical school should have a department of psychiatry for both out-patients and in-patients, with an adequate teaching staff.
> 2. There should be a course of normal psychology towards the end of the second pre-clinical year.
> 3. At the beginning of the student's first clinical year there should be an introductory course on the psychiatric aspects of clinical work.
> 4. There should be a systematic course on psychiatry extending throughout the clinical period.
> 5. Six of the lecture-demonstrations of the systematic course on psychiatry should be devoted to mental deficiency and at least two should be carried out at an institution devoted to the care of mental defectives.
> 6. Students should act as clinical clerks in the psychiatric department for three months during the first or second clinical year and should hold a short resident appointment in a mental hospital or observation ward during the last clinical year.
> 7. The clinician attached to the department of social and preventive medicine should, as supervisor of social studies, work in cooperation with the psychiatric as with other departments.
> 8. Teaching hospitals should employ more psychiatric social workers.
> 9. The student's knowledge of normal psychology should be tested by examination at the end of the pre-clinical period.
> 10. In the final examination there should be a separate examination in psychiatry which might be taken either at the end of the clinical period or at an earlier stage.

The Planning Committee of the Royal College of Physicians, London, after consideration of the reports of the committees on medical education in psychiatry, and in social and preventive medicine, has expressed its views as follows:

1. Interest in personality should be aroused early in the training of the medical student. The selection of topics discussed in the course on psychology is a matter of lesser importance, and the student should not be examined in this subject in his second degree examination.

2. The examination of the mental functions should not be overlooked in the introductory course on clinical methods.

3. In the teaching of psychiatry, lectures and lecture-demonstrations or other forms of didactic presentation are of less value to the student than having his attention drawn to emotional and situational factors in his cases throughout the clinical phase of his training. In the words of the report: "Throughout the clinical period the psychiatrist to the hospital, or a general physician interested in psychological medicine, should, from time to time, assist in the elucidation of such details in the histories, and the student should be present at consultations between physician and psychiatrist, when the emotional and physical factors of a case are placed in their proper perspective and welded into the final opinion."

But alas! one is moved to comment here:

> Never the time and place,
> And the loved ones, all together.
> —BROWNING.

To continue the quotation from the report:

It is necessary to emphasize further the information which may be obtained from relatives, both about the personality of the patient and about his environment, and it should be part of the student's duty to seek such information, and to be present at any interview which his chief may have for a similar purpose. It should be the aim of all physicans and surgeons to permeate their teaching with an interest in social medicine.

4. The committee does not favour the idea of special examinations in psychology in the second degree examination or in psychiatry at a later period, but agrees to the setting of a question in the medicine paper.

5. During the period when he is studying the medical and surgical diseases of children the student should have some experience of school medical services, child welfare and guidance clinics and children's courts.

The General Medical Council in its recommendations as to professional education which have not yet come into operation has included the following relating to psychiatry:

> Elements of normal psychology to be taught in the pre-clinical period, along with anatomy and physiology. The attention of the student should be directed to normal human growth and development.
>
> Instruction in pædiatrics should include attendance, if possible, at a number of School Medical Clinics and Child Guidance Clinics, sufficient to familiarize every student with the work of these departments.
>
> *Psychiatry.*—1. Instruction in psychiatry should be carried out mainly in a psychiatric out-patient department where neuroses and psychoneuroses can be studied.

2. A short course of systematic lectures should be given.

3. A few visits should be arranged to a mental hospital, for the observation of gross mental disorders, and to a mental deficiency institution.

During his study of all clinical subjects the attention of the student should be constantly drawn to the importance of the interrelation of physical and psychological aspects of disease.

After-Care and Rehabilitation.—Instruction should be given in the methods of after-care and rehabilitation appropriate to the particular subject.

Social Medicine and Public Health.—Utilization for purposes of instruction of such ancillary workers as almoners, health visitors, psychiatric social workers and other social workers.

Candidates should be required to pass examinations in psychiatry which may be separate or may form part of the examination in final year subjects.

In Table I are set out the requirements of some universities in the United States of America.[10]

TABLE I.

	Johns Hopkins.	Harvard.	Yale.	Columbia.	Cornell.
Preclinical lectures ..	32	10	33	20	22
Clinical lectures	20	16	—	65	66
Demonstrations	18	32	13	—	48
Clinical work (hours) ..	60	—	40	52	50

Teaching of Psychiatry in Australia.

The requirements of Australian universities are set out in Table II.

In Sydney students must attend the psychiatry out-patient department of one of the three teaching hospitals once a week for a term. They have here the opportunity of taking case histories and of examining cases for themselves. They must also in the course of their attendance at demonstrations at a mental hospital examine and report on a patient and complete a lunacy certificate.

TABLE II.

	Sydney.	Melbourne.	Adelaide.	Queensland.	Recommendations of Royal College of Physicians Committee.
Preclinical lectures ..	6[1]	12	6	10	12-20
Clinical lectures	20	12	6	20	60
Demonstrations	10	6	6	3	
Clinical work (out-patients *et cetera*) ..	Yes	Yes	—	Yes	Yes

[1] Not compulsory.

In Brisbane students attend the psychiatric ward and out-patient department of the general hospital over a period of five weeks.

In Melbourne instruction is given in the psychiatric out-patient department.

Examinations.—At Sydney during his attendance at a psychiatric out-patient department the student is examined informally. He must sit for a three-hour paper as part of his fifth year examinations. At Melbourne a question may be set in the medicine paper in the final examination. At Adelaide a two-hour paper is set. At Brisbane an oral examination is held.

Discussion.

At first sight the recommendations of the special committee of the Royal College in London appear extravagant and to be the product of wishful rather than realistic thinking. The syllabus far exceeds what is already being done in the majority of British medical schools, and indeed makes demands on facilities which are not all available—for example, a psychiatric department for both out-patients and in-patients, and a social service department. But the committee has at least formulated a plan for development, and no scheme is worth consideration that does not provide for several jumps ahead of what is immediately feasible. It may be noted that the higher authorities to whom the recommendations have been submitted have both curtailed the original proposals. One feature which I feel sure will find favour in the eyes of the majority of teachers is the emphasis on the concept of personality, thus discouraging a too narrowly mechanistic point of view, a view which the limitations of physiological experiments and the increasing number of mechanical diagnostic aids tend to foster. Personality, or shall we say, the individuality of the patient, runs the risk of being overlooked with too intense preoccupation with any single organ or visceral system. And in so far as personality is appreciated only in part when abstracted from the environment in which the individual has to live and move and have his being, the encouragement of a wider interest in social medicine, which includes consideration of the family, industrial and general social environment, a field in which the psychiatrist particularly in child guidance work has not been inactive, one may expect that many problems which at present are referred as being essentially a matter for the psychiatrist will in future more often be resolved by the general physician. Further, in so far as there are many more emotionally charged situations than can ever be dealt with by the psychiatrist or even the general practitioner, it is inevitable that the services of trained social workers will be called in to a greater extent for the investigation, control and supervision of the social environment. In the systematic course in psychiatry it is necessary to avoid that weakness of teachers of special subjects, the tendency to overload the subject, to refer in detail to the carrying out of techniques which should remain in the hands of the specialist, and in general to teach to too high a standard. Further, theoretical instruction, and to this may be added the presentation of selected cases where the student is only a looker-on, tends to be out of all proportion to the students' opportunities of getting practical experience. Attendance in the out-patient department is therefore of value for practice in case taking as well as for the cases which present the kind of problems with which the general practitioner has to deal. With the increasing number of students—over four hundred are expected to enter on the clinical part of their training in Sydney in a couple of years—the adequate presentation of lectures becomes more difficult. Greater use of visual education—slides, illustrations and perhaps also motion pictures (the English film on the work of neuropsychiatric hospitals, and a recent film on narcoanalysis)—to say nothing of the psychiatric subjects presented in the public theatres—will all help. could we invite Mr. Walt Disney to make an instructional film in his remarkable style, with Donald Duck in the title role as an acute mania, or Micky Mouse in a schizophrenic episode?

Demonstrations should be given to groups as small as the number of teachers and the time of the students allow. If a tutorial atmosphere can be introduced, so much the better. The completion of a lunacy certificate at a mental hospital is good practice and it may provide the only opportunity for the student to examine a certifiable case.

Visits to such organizations as school and child guidance clinics and juvenile courts seem hardly likely to be practicable in the near future. Moreover their work does not readily lend itself to demonstration even to small groups. But the objects of these special clinics should certainly be discussed in the clinical course.

In a discussion with a senior physician regarding the extent to which the general medical staff might be prepared to emphasize the psychiatric aspects of their patients' conditions, the opinion was expressed that in his particular hospital the taking of histories by the resident staff was

inadequate largely through the number and variety of their duties, but also through lack of adequate facilities for examination. It was hoped that before long suites of examination rooms would be attached to the wards with better diagnostic equipment and also providing that degree of privacy which is so necessary when personal matters are being discussed and investigated.

Examinations are, in my opinion, desirable, indeed essential, to give a subject adequate prestige. They at least ensure that the student acquires some ideas on the subject; even though he may not be proficient in their practical, that is to say, clinical, application. And examinations are good for the teacher in so far as they provide a motive for more careful formulation and expression of what he has "put across" to his class. May I offer you a few gems of wisdom from recent papers? "The absurd anti-psychological materialism of orthodox medicine", wrote one who evidently had already come under the influence of an enlightened and psychosomatically minded physician, "the absurd anti-psychological materialism will produce few cures in the anxiety neurosis." In answer to the same question about anxiety states another student wrote: "Therapeutic bluff by the use of foul flavoured but ineffective drugs may be tried, but is quite ineffective." Also: "In adults strong emotion usually affects the appetite, for example, I had no breakfast this morning." For the treatment of hysterical tantrums another student suggested that the doctor should take the girl into a room alone and then neglect her. He also wrote: "There is generally an overanxious mother running about with a bowl and she will eventually become sick of it." With regard to the treatment of a common and vexatious complaint of childhood one examinee wrote: "The old method of rubbing the child's nose in the bed clothes should definitely be barred." The student who wrote the following is evidently a romantic, or had she herself suffered? "Who is not acquainted with the beautiful heroine, disappointed in love, who gradually fades away, to die in solitary silence of a broken heart?" Finally, the therapeutic pessimist who considered that the outlook as regards treatment was bad, while the prognosis was good.

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PSYCHOLOGICAL MEDICINE AND THE COMMUNITY.[1]

By JOHN BOSTOCK,
Brisbane.

AT your invitation I wish to say a few words concerning the relationship of psychological medicine to the community. I do this with a deep sense of responsibility. Our privilege in belonging to an interesting specialty of a great profession bears with it a definite responsibility. We have knowledge; it is our duty to carry it to the community.

I am reminded of the great Isaac Newton, who, after surveying the fall of a homely apple, drew certain deductions which have been translated into every form of scientific endeavour. In like manner, observations of one patient in the test-tube atmosphere of the consulting room may have an importance far beyond its confines. Individual medical psychology is an experiment in the wider and equally important field of mass psychology.

At the outset we learn the basic principles that man is not primarily a thinking but rather an emotional and instinctive organism. This knowledge is fundamental, since one finds that the same qualities are often spilled over into community effort with disastrous results. We discover that many activities, lauded on the basis of alleged reason, are often mere psychological rationalizations used to buttress emotional urges or to conceal impulses and habits which are derogatory.

It is for this reason that no community activity should take place without a survey from the psychiatric angle. The psychological X rays must pierce the wrappings of the obvious, to make sure that psychological disasters are not concealed within the folds of community planning. Often harmful avenues are exposed for the encouragement or exploitation of the emotions—cunning, greed, laziness, thriftlessness, aggression or pleasure-seeking. The psychiatrist realizes that mental growth is largely that of habit. The virtues are fragile; they need careful pruning and cultivation. They can be destroyed overnight by an action which, though dictated by good intentions, is based on ill-considered psychological principles.

Let me briefly discuss such community fields.

War.

The prevention of war is a medico-psychological problem. Instincts of aggression, emotions of greed, are universal. Wars will not cease until mankind forgets the placebos of pacts, security leagues and treaties. The problem of war prevention is the mass sublimation of the instincts of aggression and of the emotion of greed. Just as the individual must learn the friendliness of community living and the outlawing of individual aggression, so must communities to learn to forgo certain national sovereign rights and in their place adopt a sincere international good-neighbour policy. It is our responsibility as a psychiatric organization to work for world peace through the dissemination of psychological principles.

Industry.

Today we are inundated by blueprints for industry. There are vast schemes for the financing of building and equipment. There is scope for psychology in industry. The use of the social worker and of the industrial psychologist needs no stressing; but there are certain more intangible aspects.

The most important feature of industry is not the machine, but the psychology of the man behind it. Industry depends upon the habit of work and upon the incentive to work.

A distinguished statesman told me recently that the real problem of today is not the devising of highfalutin' schemes for this and that, but the simple one of how to restore the principle of an honest day's work for an honest day's pay.

Our crippling taxation is destroying the incentive to work in every field of endeavour, on both high- and low-scale incomes. One's emphasis upon social benefits is obscuring the reality that every benefit has to be paid somehow by someone at some time. Failure to enforce law encourages the growth of thinking in unreal terms. We cannot escape the truth that a high standard of living demands a high standard of work. There is no substitute.

As psychiatrists we can proclaim that our over-protected and often ill-digested industrial and social systems are in danger of turning us into a community of schizophrenics, living in a world of day dreams, creating a topsy-turvy world wherein work is a stupidity, ideals are fruitless, good manners a superfluity and thrift a degradation. As psychiatrists with insight it is our duty to warn society of its impending psychosis.

[1] Read at a meeting of the Australasian Association of Psychiatrists, Melbourne, October, 1946.

The Problem of Population.

Our country is in urgent need of more people. Birth restriction beyond a certain level spells national suicide. Many reasons have been adduced for this. The psychiatrist realizes that not the least of these is the active desire of an increasing number of couples to have fewer children. We are faced with the psychological problem of motivation. Our association has an important task in surveying this field and in carrying its findings to those who direct our national policies.

National Medical Service.

It may be held that the spirit of our times is the mass exploitation of the painless panacea. We want painless health at no cost to ourselves. The psychiatrist is not hypnotized by a lovely blueprint of benefits envisaged in a national medical service. He knows only too well that in playing with mass medicine he is playing with fire. Most illness is psychological; the incentive to sickness is a reality. Free medicine and other benefits can be a psychological menace. Moreover, the psychiatrist realizes the fallibility of large-scale organizations and over-centralization. He asks himself whether the patient will be well served by a doctor who is regimented in a cast-iron system, wherein the rewards will depend not on the patient's gratitude but on administrative astuteness.

Our association is not interested in the political aspect of such problems; but it is vitally concerned with the welfare of the patient and the community. Whatever scheme for medical service be adopted, it must be psychologically sound. It is our duty to work to this end.

Character and Health of Our Future Citizens.

As psychiatrists we know that the critical period for the growth and good health of our citizens occurs in early childhood and adolescence. We are deeply concerned in the treatment of all nervous deviations, neuroses and psychoneuroses. Our first line of attack must be that of prevention, otherwise we set ourselves the impossible task of the dog chasing its tail. Civilization produces such increasing numbers of mental invalids that the supply of psychiatrists cannot cope with them. Our association will help materially by its official and active encouragement of all pre-school movements aiming at better child guidance and more parent education. It will be behind all projects giving a balanced education to youth and adolescents.

Research.

Lastly, the attention of our association is drawn to the need for psychological research. In a world in which 60% of all illness is psychological and 60% of all troubles, domestic, industrial and political, are of psychological origin, the need for this is obvious. One trusts that our association will plan and work ceaselessly for research on a scale commensurate with our needs and opportunities.

Conclusion.

The foregoing data do not cover a tithe of the community activities which fall within the ambit of our association. They must be regarded as mere illustrations to general principles.

In closing, I wish to remind you that a psychiatrist in the consulting room has neither religion nor politics. In the community field he has a similar responsibility. The foregoing remarks are entirely without political bias and are applicable to all parties. Our interest as a psychiatric association is solely that of the community. We have no politics; but as citizens with special knowledge it is our duty to place it, factually and fearlessly, at the service of humanity. Such a course is not easy; it takes time and effort, it lays one open to misconception, it may make enemies. Are we justified in considering any other course if we are to satisfy the dictates of our social conscience? I hope not.

BACTERIAL ENDOCARDITIS.[1]

By J. H. HALLIDAY,
Sydney.

In recent years the term "bacterial endocarditis" has become generally accepted as being the most suitable to embrace the different varieties of "infective endocarditis". The latter is not a suitable term, as it may lead to confusion with rheumatic endocarditis, which is almost certainly the result of an infection.

Historical Summary.

Lancisi (1707) and Morgagni (1769) were among the first to describe the morbid anatomy of endocarditis. In two of their cases cerebral infarction had also occurred, though they were unaware of the connexion. Morgagni's description was as follows:

> Some of the valves that are placed at the orifices of the heart, which receive the venous blood, discovered on those surfaces that are turned towards one another little glands as it were which protuberated to the edge of the valve, and were made up of a dense, firm and compact substance.

In 1813 Corvisart introduced the word "vegetations" to describe the warty excrescences found on the auriculoventricular and semilunar valves. He thought that these must be due to syphilis from their resemblance to venereal warts. Laennec in 1834 gave a great impetus to the clinical recognition of valvular lesions by the introduction of auscultation. Bouillard (1840) in his "*Traité clinique du rhumatisme articulaire*" argued that the vegetations were inflammatory in origin, and recognized the importance of rheumatism in the ætiology of valvular disease.

Paget in 1844 first recognized the importance of congenital malformation in the ætiology of endocarditis, and Ormerod in the Goulstonian Lectures of 1851 clearly differentiated between ulcerative and rheumatic types, noting in the former that the valves and *chordæ tendineæ* were frequently ruptured and torn. In the following year Kirke recognized the origin of infarcts in the spleen and kidneys as being due to mechanical obstruction of the arteries by detached pieces of "fibrine". He also described hemiplegia, embolism of limb arteries, and the occurrence in the skin of petechiæ with pale centres. Wilks in 1868 carried this conception further and stated that "endocarditis is a wound at the centre of the circulation". Roth in 1872 studied the white spots in the retina which now bear his name.

The introduction of the clinical thermometer considerably facilitated the recognition of the bacterial type, and Bristowe in 1880 made the following statement:

> The main indications of ulcerative endocarditis are the superposition, in a case of manifest valvular disease of the heart, of remittent febrile symptoms of more or less irregularity . . . and in the occurrence sooner or later of symptoms pointing to the implication of the various organs, especially tumefaction and tenderness of the spleen, and albuminuria associated possibly with tenderness and pain in the loins.

The science of bacteriology of this time had been born and valvular lesions in dogs had been experimentally produced by the injection of *Staphylococcus albus* in potato emulsion, and in 1886 this organism was isolated from a case of endocarditis in man.

In the Goulstonian Lectures of 1885 Osler gave his classical description of the disease under the term "malignant endocarditis", describing pyæmic, typhoid, cardiac and cerebral types. He noted the frequency with which the affected valves showed signs of previous damage and suggested that the primary lesion was a lodgement of the organism on the endothelium, with secondary involvement of the valve tissue proper. In the following year Netter published his review of ulcerative endocarditis complicating pneumonia. He demonstrated pneumococci in the vegetations and blood stream.

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on July 25, 1946.

Taylor in 1891 described the nephritis, the optic neuritis and retinal hæmorrhages, and the progressive anæmia. Cultural examination of the blood as a diagnostic procedure now came into general use, and many causal organisms were isolated, the meningococcus being cultivated in 1903.

By the turn of the century the higher incidence of the condition in the male sex was recognized, and further study led to the clearer differentiation between bacterial, rheumatic and "marantic" types of endocarditis.

The more chronic types of the disease, originally described by Osler in 1893, began to attract attention, and in 1903 Schottmüller described the discovery of the peculiar streptococcus of low virulence, labelled by him as *Streptococcus mitior seu viridans*, which is frequently the causal organism in the more chronic cases.

Libman in 1906 pointed out that the cultivation of organisms from the blood, even in the presence of valvular heart disease, was not necessarily diagnostic of bacterial endocarditis. He also recognized the fact that "there seem to be two types of cases: one in which a bacteriæmia, which in itself would not be fatal, sets up an endocarditis which keeps up the bacteriæmia and dominates the clinical picture. In the second type the bacteriæmia plays the main role."

By 1909-1910 practically all the clinical and bacterial features of bacterial endocarditis were recognized, and the descriptions of Osler, Billings, Schottmüller and Horder left little to be added.

It yet remained to discover any form of therapy which would successfully overcome these almost uniformly fatal infections. The hope that we now have such an agent prompted the reading of these papers tonight. Interest in treatment was first quickened by the undoubted effect of sulphonamides, and subsequently spurred to its present pitch by the use of penicillin and by the very real hope of cure that has been aroused by its use.

General Considerations.

Bacterial endocarditis occurs in acute and subacute or chronic types. In some of the acute forms it may not be possible to detect the presence of endocarditis during life, and it is the overwhelming blood-stream infection by pyogenic organisms which dominates the clinical course and produces the final outcome. The endocarditis in these cases is frequently established on previously undamaged valves, and the right side of the heart is often affected, a rare happening in the subacute type. Cases in which the endocardial lesions determine the clinical manifestations are grouped into acute and subacute types, the former causing a severe febrile illness measured only in days or weeks, the latter smouldering on for months. This subdivision is somewhat arbitrary and will be further discussed by Dr. Jean Armytage. Of 134 cases met with at the Royal Prince Alfred Hospital between 1926 and 1945, 26 were of the acute and 108 of the subacute type (74 other cases do not fulfil the usually accepted diagnostic criteria and have been discarded). Our main concern tonight is with the subacute type of the disease, some important aspects of which will now be discussed.

Preexisting Heart Disease.

In subacute bacterial endocarditis the soil in the form of damaged endocardium is the most important factor in ætiology. In the great majority of patients (90% or more) this is rheumatic valvular heart disease. Most of the remainder have congenital malformations, of which the most important are patent *ductus arteriosus*, patent interventricular septum and the rarer coarctation of the aorta.

It is most uncommon for the subacute form, in contradistinction to the acute forms, to arise in the absence of appropriate murmurs, and any such diagnosis must be carefully reviewed. It has been stated that one-third of patients with congenital heart lesions who survive childhood, and one-fifth of patients with chronic rheumatic valvular disease develop subacute bacterial endocarditis. The valvular lesions usually present are aortic and mitral regurgitation. Subacute bacterial endocarditis does not arise so commonly in stenotic lesions of these valves, and this may partly explain the puzzling predominant incidence in males, in whom mitral stenosis is not a common occurrence.

Kelson and White, in a review of 250 cases, commented on the unexpectedly high incidence of cases clinically diagnosed as mitral stenosis—90 cases, with 22 more suspected. On checking the autopsy findings in 19 of the 90 cases, they found that mitral stenosis was in fact present in only three and that of five of the suspected cases in which autopsy was performed mitral stenosis was present in none. They suggest that the apical diastolic murmurs present were due to the bacterial vegetations, to aneurysm or perforation of the cusps, to dilatation of the left ventricle or to aortic regurgitation.

Subacute bacterial endocarditis rarely occurs on aortic valves damaged by syphilis or on the valves of a previously undamaged heart.

Another unusual association is that of subacute bacterial endocarditis with established auricular fibrillation. Paul White states that "this is extremely rare; so striking is this fact that the presence of that irregularity may be taken to mean that subacute bacterial endocarditis is probably not in progress". It is of interest to record that two such cases have been met with in the last year.

CASE I.—E.B., a male patient, aged forty-six years, was transferred from a country hospital to the Royal Prince Alfred Hospital on April 26, 1945. He had awakened three weeks previously with an attack of "cold shivers" and had had a second shivering bout on the following day. Five days later he developed pain in the right iliac fossa with vomiting, and his urine was found to contain blood. On his admission to the Royal Prince Alfred Hospital he was febrile, complained of pain in his right thigh, and had a tender reddened area on the left great toe. Auricular fibrillation with a mitral systolic murmur was found to be present, and he stated that he had been aware of irregular heart action for some years. Auricular fibrillation was noted by his own doctor at the onset of his illness. Blood taken forty-eight hours after his admission to hospital yielded a growth of *Streptococcus viridans*, and two further samples also gave positive results. The organism was sensitive to penicillin (growth was inhibited by 0·015 unit of penicillin per millilitre of medium). Numerous blood cells were present in his urine. The leucocytes numbered 23,000 per cubic millimetre, 79% being neutrophile cells. His blood sedimentation rate was 16 millimetres in one hour. An electrocardiogram revealed auricular fibrillation with changes suggestive of myocardial damage. He was given 40,000 units of penicillin intramuscularly at intervals of three hours for fourteen days—a total of 4,480,000 units. His general condition progressively deteriorated, with increasing signs of congestive cardiac failure from which he died on July 21. Autopsy revealed gross enlargement of the heart. The mitral valve admitted four fingers, and on the auricular surface of the cusps, small, firm vegetations were present. A small roughened area was seen on the auricular endocardium above one cusp. The aortic valve cusps were slightly thickened, but showed no vegetations.

CASE II.—C.D., a male patient, aged sixty years, had been treated in 1939 for an episode of congestive cardiac failure associated with auricular fibrillation. He remained well until November, 1945, on maintenance doses of digitalis, when he became increasingly breathless, and once more showed evidence of congestive failure. He was put to bed, where he lost all desire for food, became thin and pallid, and was found later to be febrile. Splenic enlargement became evident, and his blood yielded a growth of *Streptococcus viridans*. He was given a prolonged course of penicillin, and all evidence of his infection disappeared. He still shows some evidence of congestive cardiac failure.

Organism.

On the soil described the organism which is responsible for the infection in 90% to 95% of instances is the *Streptococcus viridans*. This organism is a frequent invader of the blood stream after upper respiratory tract infections or dental procedures. It rarely causes the acute form of the disease.

Recently attention has been drawn to other types of streptococci and to the *Hæmophilus influenzæ* group in relation to subacute bacterial endocarditis, and these will be discussed later by Dr. Armytage.

Infected emboli lodging in the vessels, which are present in scarred valves or beneath the endocardium, are a

potential cause of the formation of the characteristic lesions; but it is generally accepted that the valvular lesions at least are due to the deposition of bacteria in the minute platelet thrombi which occur along the lines of closure of the valves or at places where structural defects cause unusual blood-stream or soft-tissue friction.

Age.

The disease may be met with at both extremes of life, instances having been recorded at two and a half and eighty-two years respectively; but it is commonest in the third decade. The age incidence may be seen in the accompanying graph (Figure I). In the 134 cases met with at the Royal Prince Alfred Hospital between 1926 and 1945 the age incidence closely resembles that shown by Horder and Thayer (Figure I).

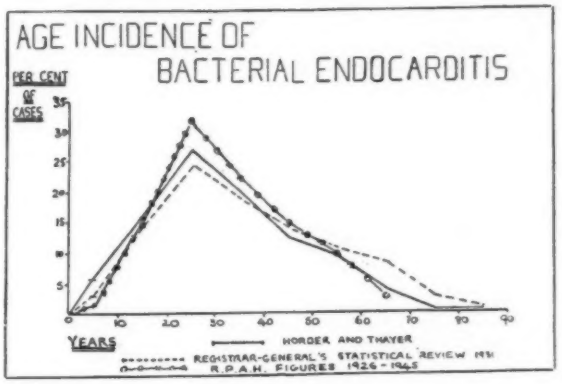

FIGURE I.

Sex.

The greater incidence in the male sex has already been mentioned. In the present series, in the subacute group 61 patients were males and 47 were females. In Kelson and White's series the male sex was preponderant in the ratio of about two to one (161 to 89). Of the patients with the condition in acute form in the present series, 12 were males and 14 were females.

Predisposing Causes.

Dental Infection.—Libman in 1910 astutely assumed that the portal of entry was "about the teeth or their roots, the tonsils, and accessory sinuses, or other parts of the upper respiratory tract". Dental infection and extraction figure in many case histories. In the 108 subacute cases of our series no record was given as to the state of the teeth in 51 patients. Twenty-six patients were described as having teeth in good condition, six were edentulous, and dental sepsis was noted in 25, approximately 22% of the total. The preeminent importance of dental infection is not sufficiently recognized by either the medical or the dental profession. Okell and Elliott's work in 1935 drew attention to the fact that the removal of infected teeth was followed by bacteriæmia in 70% of cases and that even the act of chewing with infected teeth might cause bacteriæmia. Favour, Janeway, Gibson and Levine (1946) stated that specific inquiry had been made during the preceding two years with regard to dental sepsis. Ten of their 21 patients had dental infection or had had extractions. Kelson in a recent close study of his own cases estimates that subacute bacterial endocarditis followed dental procedures in one out of every four cases. This is further emphasized by the fact that when edentulous patients develop subacute bacterial endocarditis the organism is usually not *Streptococcus viridans*. However, in the case of the six edentulous patients mentioned in our own series, *Streptococcus viridans* was present in two, a non-hæmolytic streptococcus was described in two, in the fifth no organism was grown, and in the sixth no culture from the blood was attempted. Teeth extractions immediately prior to the onset of the illness were recorded in seven of our case histories (6·5%).

Active Rheumatic Heart Disease.—A difference of opinion exists as to the relationship between active rheumatic heart disease and subacute bacterial endocarditis. Levine places great stress on the positive skin reactions to the intradermal injection of streptococcus nucleoprotein. He states that 85% of patients with active rheumatic disease give positive reactions and that patients with subacute bacterial endocarditis rarely do so (74 of 77 patients suffering from subacute bacterial endocarditis gave negative results). Levine infers from this that an incompatibility exists between these two conditions.

Kelson and White believe that subacute bacterial endocarditis may activate acute rheumatism, which should be suspected with the development of tender, swollen joints, epistaxes, prolonged auriculo-ventricular conduction time or auricular fibrillation. They have also found that subacute bacterial endocarditis may occur during the course of rheumatic fever, and suspicion should be aroused by the onset of chills, visceral emboli, repeatedly positive blood findings, splenomegaly and clubbing of the fingers. The interesting findings and views of Von Glahn and Pappenheimer in this connexion will be discussed by Dr. Armytage.

Clinical Manifestations.

The clinical manifestations are remarkably varied and may be so dramatic as to cloud the mind of the observer with regard to the underlying disease. The diagnostic criteria enumerated by Horder in 1926 may still be accepted. These were as follows:

1. The occurrence of multiple emboli. The area infarcted by these emboli may vary in size from a whole limb to a portion only of a glomerulus; but their importance in diagnosis is equally great.
2. The presence of signs of valvular disease of the heart.
3. The occurrence of pyrexia; even in the most chronic types some irregular fever is found if watched for sufficiently.
4. Positive blood findings.

The first three of these are essential to diagnosis.

The salient features thus depend on three underlying processes: infection, embolism and intrinsic cardiac damage. Any single one of these or a combination of them may be responsible for the clinical picture.

The onset in many instances is insidious, with slow progression of events, due chiefly to the infection itself. The patient complains of increasing malaise, becomes easily fatigued, develops anorexia with loss of weight, remains feverish and becomes pallid. Alternatively, the onset may be sudden, with a major embolism, the patient having been in normal health previously. In most instances, however, close questioning will reveal a period of malaise preceding the major happening.

CASE III.—S.J., a male patient, aged sixty years, was admitted to the Royal Prince Alfred Hospital on April 5, 1945, in an aphasic condition. His son said that he had not been feeling well for twelve months, and had lost his appetite. This was thought to be due to a gastric ulcer, for which he had been treated after a hæmorrhage two years previously. He had been a heavy smoker and drinker all his life. He had become confused and inarticulate twenty-four hours before his admission to hospital.

On examination, the patient was agitated and had a jargon aphasia, and appeared to be completely disorientated. A blowing systolic murmur was present at the mitral area. Some nystagmus to the left was present, and the knee and ankle jerks were sluggish; the plantar responses were flexor in type. There appeared to be some neck rigidity. The liver edge was palpable two and a half inches below the costal margin. Examination of the cerebro-spinal fluid revealed no abnormality and the Wassermann test produced no reaction. Nine days after his admission to hospital crepitations were audible at the base of the right lung. He became febrile for the first time a week after admission to hospital, and eleven days later had a rigor. Blood was taken for cultural examination, but the result was negative. On microscopic examination his urine was found to contain

profuse red blood cells. A blood count revealed that the hæmoglobin value was 10·2 grammes *per centum*, and that the leucocytes numbered 13,000 per cubic millimetre, of which 93% were neutrophile cells. Four blood samples taken during this period all yielded a growth of *Streptococcus viridans*. The growth of this organism was inhibited by 0·15 unit of penicillin per millilitre of medium. A faint aortic systolic murmur became audible, and percussion revealed enlargement of the spleen. He was given 40,000 units of penicillin intramuscularly every three hours, and sulphadiazine by mouth. The latter drug was suspended after a fortnight, but the penicillin was continued for three weeks, a total of 8,000,000 units being administered. A number of attempts at blood culture were made during and subsequent to treatment, but all gave negative results. Seven weeks after the completion of his treatment his urine contained only occasional red blood cells. He has remained well since—that is, for thirteen months after completion of his treatment—with progressive improvement in his speech, which is now almost completely restored. A recent attempt at blood culture failed to produce a growth of organisms, and examination of his urine revealed a small number of red cells.

In other instances, particularly after tooth extractions, the infectious factor may dominate the picture from the onset, with the occurrence of rigors and high intermittent fever.

CASE IV.—F.S., a male patient, aged thirty years, was admitted to hospital on October 11, 1945, with a note from his doctor to the following effect:

> This patient gave a history of general malaise, pyrexia and sweats since he had some dental extractions some five to six weeks ago. I first saw him a week ago, and since his admission to hospital he has run a persistent temperature and has looked ill. He has a harsh systolic murmur at the apex, and I know this was not there a year or two ago. I do not think there is much doubt that he has bacterial endocarditis.

On his admission to hospital the patient stated that he had had bad teeth for many years, and that since the removal of five teeth five weeks previously he had felt persistently tired and had vomited occasionally. Two weeks before his admission to hospital he had had an attack which he thought was influenza, with cold feelings and cough. He had had rheumatic fever at the age of fourteen years. A blowing systolic murmur was audible at the mitral area. The spleen was not palpable. He had an intermittent temperature ranging to 100·6° F. The blood yielded a culture of *Streptococcus viridans*. Microscopic examination of the urine revealed a small number of red cells with an occasional hyaline and granular cast. A blood count revealed that the hæmoglobin value was 13 grammes *per centum*, and that the leucocytes numbered 12,400 per millilitre, of which 75% were neutrophile cells. His blood sedimentation rate was 16 millimetres in one hour (normal, five millimetres after one hour). Penicillin treatment was commenced after the positive blood finding was obtained; the drug was given in a dosage of 40,000 units every three hours for three weeks—a total dosage of 7,040,000 units. During the administration of the penicillin radical removal of the remaining infected teeth was effected under anæsthesia. During treatment the patient also developed three series of small painful areas on his finger tips and on the palms of his hands; two of these had pale centres. The blood sedimentation rate remained elevated for some weeks after completion of his treatment, but had returned to normal by January 16, 1946. In response to a recent inquiry, he wrote to say that he was feeling well and had had no further symptoms.

The preexisting cardiac damage may be aggravated by further valvular destruction, also by the general effect on the myocardium of fever and anæmia, and at times by embolism. These may cause alteration in the cardiac murmurs present, though many cases run their course with no detectable change in these. The heart may also increase in size, and varying degrees of congestive cardiac failure may appear, as has already been instanced.

In Kelson and White's series already mentioned, the frequencies of the important findings were as follows: heart murmurs, 99·2%; fever (chills present in 40·5%), 100%; splenomegaly, 59%; clubbed fingers, 46%; hæmaturia, 49%; petechiæ, 86%.

The spleen becomes enlarged in every instance, but may become clinically enlarged only relatively late in the disease. Hæmaturia may indicate infarction or a focal embolic or diffuse glomerulonephritis, and the persistence of microscopic amounts of blood in the urine of patients apparently cured by penicillin is of great interest and indicates that further observation of these patients will be necessary. The petechiæ are apparently of two types, those with pale centres being of embolic origin and the others being due to toxic action on capillary endothelium.

It should be emphasized that delay in making and repeating attempts at blood culture constitutes the chief factor in the failure to recognize promptly the true nature of the patient's illness. This procedure should never be omitted in the case of a patient with cardiac murmurs who has fever and constitutional disturbance. Positive results may be expected in at least four-fifths of these cases. It may be said that, with rare exceptions, a patient who repeatedly has *Streptococcus viridans* in his blood is suffering from subacute bacterial endocarditis.

Differential Diagnosis.

From the present and other series it is apparent that subacute bacterial endocarditis may be mistaken for many diverse conditions. Influenza is prominent as the initial diagnosis in a great proportion of cases. The reactivation of rheumatic carditis has often been postulated also. At times embolic manifestations have suggested intracranial or acute intraabdominal disease, and under these headings a great number of diagnoses have been recorded. Time will not permit of discussion of these.

Treatment.

Prior to the introduction of the sulphonamides, certain observers, notable amongst whom was Libman, held that spontaneous cure took place in a small percentage of cases of subacute bacterial endocarditis. This view was supported by the post-mortem finding of healed calcified vegetations in some patients who had died from other causes, and also that in certain patients who had died of this disease some of the vegetations appeared to be healing or healed whilst others were still active. Unfortunately, in the experience of most clinicians the disease, once established, progressed inexorably to death, despite the use of antiseptics of many types, and in spite of other heroic measures, such as the infection of the patient with rat-bite fever or the removal of the left breast and searing of the pectoral muscles, to mention only two.

As was stated earlier, the sulphonamides aroused a new hope, as some patients lost their fever and the blood temporarily failed to yield a growth of organisms. It was soon realized that the Maginot Line of vegetation pillboxes had not been stormed and that with the cessation of the drug treatment the disease once more became active. Slightly better results were obtained with the synchronous use with the sulphonamides of fever induced by typhoid vaccine or by the "Inductotherm". Some workers reported 6% of recoveries with these measures. Some of the reasons for the failure of the sulphonamides will be mentioned by Dr. Armytage.

The initial results obtained with penicillin were of the same order—so much so that in the early days of limited supply of this antibiotic the authorities controlling its distribution advised against its use in this infection. To Loewe, in 1944, must be given credit for the introduction of the greatly increased dosage now known to be necessary for the effective treatment of this disease. The other factor in the early failures was the short period of administration. These factors—the duration of treatment, the minimal effective daily dosage of penicillin, and the best mode of administration, together with the sensitivity of the organism and the general condition of the patient—constitute our chief problem in treatment at the present time. Brief consideration of each of these points is necessary.

General Condition of the Patient.

Cardiac damage and the increase in the number of major embolic incidents and in the amount of renal damage vary directly with the duration of the disease. Thus the imperative need for early recognition and

treatment of the condition must once more be stressed. The literature now abounds in series of patients whose infection has been controlled by penicillin, but who during or shortly after treatment have developed signs of gross congestive cardiac failure which has killed them. Many of these patients had been living active lives immediately prior to the onset of their infection. It is thought that the healing of the vegetations with shrinkage of the further damaged valves is largely responsible for this train of events. This unhappy ending has been experienced in the present small series.

CASE V.—G.D., a male patient, aged twenty-eight years, had several attacks of rheumatic fever between the ages of five and ten years. He was subsequently told that he had a leaking valve in his heart, but led an active life, and though he was rejected for military service, he worked as a garage mechanic until October, 1945. He then had a tooth extracted. Three weeks later he developed symptoms which he ascribed to influenza—he felt weak and listless, and had headaches and aching pain in the back and limbs. He went to bed, and during the next two weeks had a number of rigors. He was then given sulphadiazine. The rigors ceased and he felt better; but the rigors and other symptoms recurred when administration of the drug was stopped. He obtained a supply of sulphadiazine and went back to work, taking a tablet after each meal and some at night. He felt fairly well in the mornings, but at night he felt "done in" and feverish. He carried on for a month, but became increasingly breathless, lost weight and became more easily fatigued. In January, 1946, he consulted a physician, who admitted him to a hospital where he was given 1,500,000 units of penicillin. He felt much better under treatment, and was discharged from hospital after twelve days, and a week later returned to work. After one week he had to give up work and took two weeks' holiday. His symptoms recurred, with increasing breathlessness, fatigue and loss of weight, and he became distressingly weak. He noticed an increasing pallor. He was admitted to the Royal Prince Alfred Hospital on May 30, 1946, with a pulse rate of 120 per minute and a temperature of 102° F. Early clubbing of the fingers was noticed, but no enlargement of his spleen was detected. His heart was grossly enlarged; a high-pitched mitral systolic murmur and a faint diastolic murmur in this area were audible. No embolic phenomena were present. A blood count revealed that the erythrocytes numbered 3,070,000 per cubic millimetre, the hæmoglobin value was 8·0 grammes *per centum*, and the leucocytes numbered 14,800 per cubic millimetre, 84% being neutrophile cells. The blood on May 31 yielded a growth of *Streptococcus viridans*. He was given 400,000 units of penicillin per day for thirty-seven days—a total of approximately 15,000,000 units. He volunteered the information that he noticed an extraordinary sense of well-being within twenty-four hours of beginning treatment, when he also became afebrile. However, towards the end of his treatment he complained of increasing breathlessness and developed gross signs of congestive cardiac failure which have persisted until the present time.

Sensitivity of the Organism.

The sensitivity of the organism may be summed up in Professor R. V. Christie's statement:

> The resistance of the organism as measured by ordinary titration methods appears to be of no clinical importance within a wide range. Only when the organism is more than ten times as resistant as the standard test staphylococcus does this measurement appear to be of therapeutic or prognostic influence.

This, of course, implies that for intelligent management the sensitivity of the patient's organism must, if means are available, be determined before treatment is commenced. With an unusually resistant organism the dosage to be presently mentioned should be increased and treatment more prolonged. In these cases at least the serum concentration of penicillin should be estimated. The concentration necessary has been stated by various workers as lying between three and ten times the in-vitro sensitivity of the particular organism concerned. While there has not been any great weight of evidence so far of increased resistance of the organisms to penicillin in cases of inadequate treatment and relapse, this aspect has not been finally determined, and may yet prove to be of some significance.

Duration of Treatment.

The aim of treatment is to sterilize and secure complete healing of the vegetations, and it is not surprising that these bacterial masses, encompassed in avascular tissue, are able to survive short periods of bombardment even with such a mighty adversary as penicillin. While certain patients treated early after the onset, who have an appropriately sensitive organism and presumably small vegetations, may be "cured" by a relatively short course of treatment, careful survey of large groups has shown that a twenty-eight-day régime should at present be regarded as the minimum necessary period, and some observers hold that this should be considerably longer. The longer period should in any event be adopted in the case of unduly resistant organisms or whenever a relapse has occurred. Relapses were very frequent when a shorter period of treatment was given. Professor Christie has shown that relapse almost invariably takes place within six weeks of cessation of treatment. The dosage in relapse will be discussed in a few moments. When a patient relapses after a prolonged course of adequate dosage, the outlook is usually grave. It has been realized that the blood sedimentation rate, always elevated initially, may not return to normal for many weeks after cessation of treatment, and so it is of no value in determining the length of the treatment necessary.

Daily Dosage.

In cases in which the organisms fall within the usual range of sensitivity, and in the absence of other unfavourable signs such as unusually intense toxic manifestations, the daily administration of 500,000 units of penicillin should be adopted as a routine measure. This dose should be doubled when the organism is resistant or when a relapse has occurred.

Method of Administration.

There is still considerable difference of opinion as to the best mode of administration of penicillin. For this disease the oral method need not be discussed at present. Many American observers favour continuous intravenous administration, holding that the constant serum concentration so obtained is a material advantage. They believe that with the removal of impurities from penicillin local reactions have been largely eliminated. British workers have used the intramuscular route for either continuous or intermittent administration and their results appear to be as favourable as those reported from America. Intermittent administration by the intramuscular route has been used in the cases in the present series. Some evidence supporting this method will be mentioned by Dr. Armytage.

It seems advisable to persist with the three-hourly sequence of injections for this disease, though it is known that in some instances this may not be necessary, and increased experience may allow some modification of this routine.

Dental and Tonsillar Sepsis.

Finally, the problem of dental sepsis must be considered. (i) All patients with rheumatic valvular disease or congenital lesions should maintain their teeth in scrupulous order throughout life. (ii) If tooth extraction for dental sepsis has to be carried out, penicillin should be administered for twenty-four hours before and for two or more days after these procedures. This view should be disseminated throughout the dental profession. (iii) All patients with subacute bacterial endocarditis should have all dental sepsis radically treated while undergoing penicillin therapy. This has been the practice in recent cases, as has already been mentioned.

Under certain conditions these considerations may apply to infected tonsils.

Conclusion.

In conclusion it may be stated that with this form of chemotherapy subacute bacterial endocarditis has been removed from its former deadly status as an incurable disease. In general, the outcome of treatment depends on

factors affecting both patient and organism. Those patients who are treated early after the onset of their bacteriæmia, who have relatively small vegetations, who show no signs of circulatory failure, and whose infection is caused by a penicillin-sensitive organism, have the optimal chance of cure. This demands a watchful attitude in the case of any patient with valvular heart disease who becomes febrile, and the earliest possible diagnosis. Repeated attempts at culture of organisms from the blood should be carried out when any doubt remains as to the cause of the fever.

The possibility of reinfection by a similar or different organism remains, as the appropriate soil is still present. The elimination of dental sepsis in the prevention and treatment of the disease is of the greatest importance. Congestive cardiac failure, and possibly progressive renal damage, will still take a considerable toll of these patients. Remotely, the incidence of the disease will be greatly reduced when the ravages of acute rheumatism can be prevented.

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BACTERIAL ENDOCARDITIS.[1]

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Sydney.

FROM what Dr. Halliday has said, it is clear that at last we have a weapon against that distressing disease bacterial endocarditis, and so we are at present at one of those dramatic points in medical history which can be appreciated only by those who like us have passed through the transitional period. Once we have discovered an adequate weapon against a disease, interest tends to wane, although many problems may remain unsolved. At this juncture, therefore, let us pause and review what we have learnt up to date and consider some of the questions which still remain unanswered.

Bacterial endocarditis has been arbitrarily divided into acute and subacute types according to the course the disease runs and to its bacteriology, the subacute type being caused by the non-pyogenic streptococci and the acute type by the pyogenic organisms. Whether this subdivision is a good one is open to question, since the pyogenic cocci are alleged to cause an illness which in duration and other respects is similar to subacute bacterial endocarditis, and conversely, subacute bacterial endocarditis can occasionally be a severe and rapidly terminating illness. However, other methods of classification also have their disadvantages, so for the present the nomenclature remains.

In the acute variety, the endocarditis may be incidental; that is, it may occur during the course of a generalized infection which would itself have been fatal—for example, in the course of *Staphylococcus pyogenes* septicæmia. On the other hand, the endocarditis may be secondary to a primary focus which would not in itself have been fatal—for example, pneumococcal endocarditis complicating pneumonia. The subacute type of endocarditis, which is by far the more interesting and comprises the greater number of cases of bacterial endocarditis, is a primary infection of the heart valve. In the Royal Prince Alfred Hospital series, during the twenty years from 1926 to 1945, there were 26 cases of the acute type compared with 108 cases of the subacute type.

It is the type of organism involved which produces the pathological changes and clinical aspects characteristic of the acute and the subacute types. The acute type is caused in the main by the virulent invasive pyogenic cocci, which may produce metastatic abscesses in other parts of the body either from the original focus or from the infected vegetations on the heart valve. The subacute type is caused by relatively non-virulent organisms which tend to produce their lesions more slowly, with the production of the characteristic clinical picture already described by Dr. Halliday. The pathogenesis of the two types is probably more similar than we have supposed.

Organisms.

A tremendous number of different kinds of organism has been grown on culture in material from these patients, and the list is added to every year or so. Thayer's[1] composite series of 536 cases in which blood cultures were obtained gives some idea of the variety of organisms concerned (Table I).

TABLE I.

Bacterial Endocarditis: Thayer's Composite Series of 536 Cases.

Organism.	Number of Cases.	Percentage.
Streptococcus ..	335	62·5
Pneumococcus ..	79	14·7
Staphylococcus aureus	60	11·2
Gonococcus	37	6·9
Hæmophilus influenzæ	14	2·6
Staphylococcus albus ..	7	1·3
Bacillus pyocyaneus ..	1	0·2
Bacillus anthracis ..	1	0·2
Bacillus Friedländer ..	1	0·2
Total	536	100

It was Schottmüller[2] in 1903 who first drew attention to the frequency with which the streptococcus could be isolated in the subacute type of bacterial endocarditis, and Christie's[3] recently published figures emphasize what has now been known for many years—that the majority of subacute cases are due to non-pyogenic cocci, mostly the *Streptococcus viridans*. Typical subacute bacterial endocarditis has been reported as being caused by the pyogenic cocci.

Hedley Wright,[4] in 1925, pointed out with what care one must decide whether the organism isolated from the blood is the ætiological agent of the disease. He showed, not only how frequently the body is invaded by organisms at or just prior to death, but that the most common invader was the streptococcus. He also showed that patients suffering from subacute bacterial endocarditis not uncommonly have a terminal invasion of pyogenic bacteria which may be recovered from the blood before and after death. Isolated bacteriological observations on the blood, there-

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on July 25, 1946.

fore, may be very misleading, especially if they are made in the late stage of the disease or after death.

Looking through the literature for cases of subacute bacterial endocarditis caused by pyogenic cocci, one finds it difficult to be sure that any are proved to be so, for in the majority of cases the circumstances suggest rather that the organisms were terminal invaders, and in others, when the organisms were isolated early in the history, cultural examination of the blood has not been repeated. In the present series of cases there are two classical examples of subacute bacterial endocarditis in which a hæmolytic streptococcus was isolated many weeks before death; but in neither case was the bacteriological examination of the blood repeated, so that there is insufficient evidence that the hæmolytic streptococcus was ætiologically related to the disease. Even the isolation of *Streptococcus viridans* from the blood must be interpreted with care, for intermittent and usually harmless bacteriæmia occurs fairly frequently. Okell and Elliott's[5] work gives us some indication of how often the *Streptococcus viridans* may be circulating in the blood stream. As Dr. Halliday mentioned, in 75% of their cases in which the gums were infected, *Streptococcus viridans* could be recovered from the blood a few minutes after tooth extraction, and the same applied to 10·9% of 110 such cases even before extraction. The rocking of an infected tooth in its socket has also been shown to give rise to bacteriæmia, so one can well imagine that during mastication organisms from infected gums will pass into the blood stream. Tonsillectomy is also not uncommonly followed by bacteriæmia, usually caused by the *Streptococcus viridans*. It is not only these findings which make us wary when we meet the *Streptococcus viridans* in the blood, but also the fact that this organism is sometimes found in the blood stream during an attack of rheumatic fever, which may be easily confused with subacute bacterial endocarditis in its early stages.

The presence of organisms in the blood stream, therefore, must be more common than we imagine, and deductions from the results of single blood examinations may lead to errors in diagnosis; even if a non-pyogenic streptococcus is recovered from the blood on more than one occasion, this is not in itself enough to justify the diagnosis of bacterial endocarditis, but must be taken in conjunction with the other findings.

Bacterial endocarditis due to the staphylococcus is usually acute. In Thayer's series he records six cases due to *Staphylococcus albus*, and three of these followed a subacute course. As we now know, pigment production is not a criterion of pathogenicity, and although *Staphylococcus albus* strains are usually non-pathogenic, they may sometimes be coagulase-positive and pathogenic. It is likely, however, that these three cases of Thayer's were due to staphylococci of low virulence. Since the introduction of the coagulase test for the pathogenicity of staphylococci, a case of subacute bacterial endocarditis in which a coagulase-negative *Staphylococcus albus* was the ætiological agent has been reported,[6] the author commenting on the fact that the organism, like *Streptococcus viridans*, was of low virulence.

The hæmophilus group of organisms can cause an illness indistinguishable from subacute bacterial endocarditis, and the *Hæmophilus influenzæ* has been reported a number of times in this role. These organisms should be studied carefully and not identified on morphological grounds only, as they may belong to the para-influenza group, which caused four cases of subacute bacterial endocarditis reported by Harris.[7]

The non-hæmolytic streptococci isolated from patients suffering from bacterial endocarditis should be examined carefully, as it is now realized that non-hæmolytic strains and variants occur in most of Lancefield's groups of streptococci, and hæmolysis as a primary criterion of classifying streptococci is not always safe. A case of subacute bacterial endocarditis due to a non-hæmolytic strain of group K streptococci was recently reported by Penistan,[8] who remarks that the group K strains originally described were derived from routine throat swabs, and were not considered pathogenic to the patients from whom they came. It is possible that some of the non-hæmolytic strains isolated in past years were non-hæmolytic strains of the Lancefield groups.

The *Streptococcus viridans* produces a green colour on blood agar; but there are a number of different strains which have a different morphology and colony formation and different biochemical reactions, and are serologically heterogenous. Many of them are identical with organisms which normally occur in the mouth. They are nearly all sensitive to penicillin, but some strains are fairly resistant and others markedly so. According to Christie, if his recommended scheme of treatment is used, the sensitivity of the organism to penicillin as measured by routine titration methods is of no clinical significance within a wide range. Only when the organism was ten times as resistant as the Oxford staphylococcus did this measurement appear to be of prognostic and therapeutic importance.

This conclusion of Christie's is very interesting, in view of a preliminary report published in February of this year from the American workers Loewe, Sherman and their associates[9] concerning a strain of *Streptococcus viridans* not previously described, which they have called "s.b.e.". This organism was isolated from 41 patients with subacute bacterial endocarditis. All the organisms were alike morphologically and gave similar biochemical reactions, and unlike the heterogenous serological strains usually found, 90% of them were of one serological type and the remainder of another serological type. All the organisms, however, were isolated from patients who proved refractory to penicillin treatment and required a daily intravenous dose of 2,000,000 units for eight weeks. The sensitivity of the organism to penicillin is not given. Either such cases have not occurred in the English series, or Christie's routine dosage has been adequate for this organism, resistant though it is. Loewe gives 2·0 units per millilitre as the average serum penicillin level following an intravenous dose of 2,000,000 units per day. Christie's dose of 500,000 units per day given intramuscularly by three-hourly injections means 62,000 units per injection. This results in a peak in twenty minutes of 2·0 units of penicillin per millilitre of serum; this falls to 1·5 units in forty minutes, and 0·6 unit is still present after two hours. Therefore it is possible that if "s.b.e." strain has occurred in the English cases, Christie's routine treatment has dealt with it.

An interesting feature of the "s.b.e." strain is that so far attempts to recover it from the human mouth and throat have been unsuccessful. This suggests that the portal of entry may not be that usually assumed for the *Streptococcus viridans*. Further details of this "s.b.e." strain are awaited with interest.

The sensitivity of the organism should always be determined and related to treatment. The scheme outlined by Christie will probably deal with most strains; but in cases of very resistant organisms a higher dosage may be necessary. The estimation of the amount of penicillin in the blood is not a simple procedure, and need not be carried out as a routine measure; but when the results of treatment are not what they are expected to be from the sensitivity of the organism, or in cases of relapse, the blood penicillin levels may give the explanation of the failure. Observers vary in their recommendations for the blood levels required; some hold that only two or three times the inhibiting dose is necessary, while others recommend five to ten times this dose.

One of the most important things about cultivating the *Streptococcus viridans* is to keep the culture material under observation for at least a week, as these organisms are notoriously slow in showing growth. The reason for this growth lag is not understood, for neither the antibacterial substances in the patient's blood nor the number of organisms per millilitre is responsible, and the lag is not exhibited by the laboratory culture of the same organism. The characteristic appears to be inherent in the freshly isolated organism, and the practical point about this feature is to keep the culture long enough to ensure that this growth lag has passed, that is, for at least a week.

The important things about cultural examinations of the blood in bacterial endocarditis are as follows.

1. Attempts at culture should be made repeatedly, and material should be inoculated onto both liquid and solid media.

2. The inoculated media should be kept under observation for at least a week.

3. Interpretation of the results should be most careful.

4. Terminal and post-mortem cultural findings are unreliable.

The vast majority of cases of bacterial endocarditis, then, are of the subacute variety, and are mostly caused by the *Streptococcus viridans*, an organism which in other circumstances is relatively harmless. The other organisms which have been proved to cause the subacute variety are also suspected of being of low virulence. Here, then, we have the remarkable phenomenon of a fatal disease caused by a microorganism of very low pathogenicity, which is indeed often a normal inhabitant of the mouth, which does not usually invade the tissues and which is of low virulence for laboratory animals. Why is it that subacute bacterial endocarditis due to this organism of low virulence is far more common than the acute variety? Bacteriæmia caused by a variety of organisms is not infrequent; yet it is the relatively non-pathogenic *Streptococcus viridans*—this wolf in sheep's clothing—which is the most adept in gaining a foothold on the valve. It may be that *Streptococcus viridans* bacteriæmia is more common than any other; but we have no evidence of this at present.

Problems Concerning the Pathogenesis of Bacterial Endocarditis.

The mode of infection of the valve has been the subject of a considerable difference of opinion throughout the years, some supporting the embolic theory and others holding that infection of the valve comes from without. Gross's[10] report on the blood supply of the heart valves (1937) proved beyond question that the greater part of the normal valve is avascular, and it was thought that infection from within the valve could not therefore take place. In damaged valves, however, blood vessels are present as part of the inflammatory response. The extent of the vascularization of the damaged valves will depend partly on the stage of the lesion. It was thought that here was the reason for the implantation of bacteria on damaged valves, especially as bacterial endocarditis was uncommon in advanced mitral stenosis, in which no doubt the healing process has progressed to the stage at which few if any blood vessels are present. However, the organisms in the vegetation are situated close to the surface, and in the subacute variety are not found in the valve cusp. This appearance, together with the experimental work of MacNeal,[11][12][13] to be mentioned later, makes it probable that the organisms are implanted from the heart blood. Therefore the evidence against embolic infection is not complete, but the structure and position of the vegetation are strongly in favour of the infection's taking place from without.

Dr. Halliday has stressed the view that certain cardiac lesions are predisposing factors to bacterial endocarditis. This predisposing effect is pronounced in the subacute type, but it is also present to a considerable extent in the acute variety. In Thayer's series of 306 cases there was clinical or pathological evidence, or both, of preexisting valvular disease in 58% of the acute and in 72% of the subacute cases. Gross and Fried in 1937[13] reported that in 21 out of 27 acute cases the condition was superimposed on a previous rheumatic process. In our Royal Prince Alfred series, of the cases in which autopsy was performed, in 70% of the subacute and in 33% of the acute cases the condition was superimposed on a previous rheumatic lesion (see Table II). Syphilitic valvular damage does not appear to have this predisposing influence.

These findings have stimulated workers to try to find some difference between the vulnerable and the resistant valve.

In 1928 Grant *et alii*[14] examined valve surfaces carefully, and found on some valves minute platelet thrombi. These thrombi were observed more frequently and in greater numbers on those very valves which we know are particularly prone to bacterial endocarditis; that is, they were on 11 out of 22 mitral valves previously attacked by rheumatic infection and on five out of ten bicuspid aortic valves; but they were present on only two out of forty normal hearts and on one out of fourteen syphilitic hearts. Grant suggests that it is these platelet thrombi which entangle the circulating bacteria and allow them to establish a focus of infection. He also thinks that the thrombi arise as a result of any damage, either infective or traumatic, the latter being particularly likely to occur when malformation of the valve subjects it to more mechanical force than usual.

TABLE II.

Bacterial Endocarditis: Royal Prince Alfred Hospital Figures, 1926 to 1945.

Observations.	Acute.	Subacute.
Number of autopsies ..	24	62
Number of rheumatic valves	8	44

The relation of rheumatic infection to subacute bacterial endocarditis is a much-debated question. It was once thought that the one was a more severe manifestation of the other; but it is now accepted that subacute bacterial endocarditis is a secondary infection when superimposed on a rheumatic lesion. Von Glahn and Pappenheimer[15] in 1935 put forward a theory that acute rheumatic infection with recent or active vegetations was a necessary antecedent to bacterial endocarditis in persons who had had rheumatism. They maintained that it was not the old scarred valve which was susceptible to infection with bacteria, but the valve or heart wall on which were fresh unhealed verrucæ. Their evidence in favour of this was that vegetations histologically identical with those present in rheumatic infection were found on the same valve as the bacterial vegetation, on other valves on which there were no vegetations containing bacteria, and on the heart wall.

Gross and Freid[13] hastened to deny this theory. Gross, who has been interested in rheumatic carditis for many years, maintained that there were such things as non-rheumatic verrucæ, and that it was possibly these that Von Glahn and Pappenheimer had found. He himself found such lesions in hearts proved by his standards to be non-rheumatic, and he stated that these non-rheumatic verrucæ occurred side by side with bacterial vegetations, in both bacterial endocarditis superimposed on rheumatic valves and in bacterial endocarditis occurring on normal valves. Certainly if Von Glahn and Pappenheimer were correct, one would expect subacute bacterial endocarditis to be far more common in childhood, when active rheumatic carditis occurs frequently; whereas subacute bacterial endocarditis reaches its peak incidence in the third and fourth decades.

Probably some of the most interesting experimental work which has been done of late years is that of MacNeal and his co-workers[13][14] in America. They found that they could produce bacterial endocarditis fairly constantly by the inoculation of *Streptococcus viridans* into the ears of rabbits. The anatomy of the rabbit heart valve is similar to that of the human heart valve, for it, too, is avascular, and so some comparisons at least can be drawn between this experimental disease and the human infection. From a series of studies a number of interesting facts has emerged. MacNeal *et alii* found that the injected organisms were taken up by the wandering cells, and also particularly by the endothelial cells of the smaller blood vessels throughout the body and by the endocardial endothelium and that of the coronary vessels. Most of the bacteria are evidently destroyed, no recognizable structural damage being left behind; but in some places, particularly on the heart valves, the included bacteria tend to survive and

multiply and in many cases finally produce a typical vegetation.

The problem which has exercised the minds of all workers interested in this disease is why the body cannot deal with *Streptococcus viridans*. By whatever means it reaches the valve and gains a foothold, why is it that the body cannot overcome this focus of infection in a very short time? During the course of the disease the patient appears able to deal with infections such as paronychia and abscesses caused by far more virulent organisms. The body's defence mechanisms against the *Streptococcus viridans* are certainly stimulated, the antibody content of the blood against them being usually very high, and the blood is actively bactericidal. However, the *Streptococcus viridans* will grow in serum, either normal or from the patient, but growth is inhibited if leucocytes are added; this indicates the important part which the leucocytes play in the destruction of the organism. This is one of the great factors involved in the survival of the organisms on the valve.

Looking at a section of heart valve on which there is a vegetation, we see that the plugs of bacteria are covered with a layer of fibrin. They occur close to the edge of the vegetation, and usually most of them are in the form of fairly circumscribed circles of bacteria—that is, actively growing colonies. It appears to be the early establishment of these colonies which prevents the valve from dealing with the organisms. One of the most striking features of the vegetation is the absence of polymorphonuclear leucocytes in the neighbourhood of the masses of bacteria.

These two facts—namely, (i) that the bacteria are separated from the blood stream by a barrier of fibrin, and (ii) that polymorphonuclear leucocytes are not present near the organisms in the vegetation—evidently play an important part in the failure of various types of treatment. The barrier of fibrin no doubt prevents free communication between the bacteria and the circulating antibacterial agents, and some factor or factors prevent polymorphonuclear leucocytes from approaching the colonies of bacteria. Antibodies and chemotherapeutic agents which do manage to reach the organisms are therefore unable to destroy them. This prevention of the approach of the leucocytes may be mechanical, by the fibrin barrier; but it is more likely to be due to an exotoxin produced by the actively growing colony of bacteria. Fibrin has been shown to be an excellent culture medium, and one in which colonies of *Streptococcus viridans* can multiply and survive for long periods. A fibrin clot is permeable to the sulphonamide drugs. A fibrin and platelet clot and a blood clot are not so permeable. The permeability of a vegetation to penicillin has not been investigated; but as penicillin does not penetrate blood clot to any extent, it probably does not penetrate a vegetation either. If neither penicillin nor the sulphonamides penetrate the vegetation easily, there must be some explanation for the success of penicillin in treatment and for the failure of the sulphonamide drugs in those cases in which the organism is sensitive to both. Probably several factors are concerned. In the first place, one of the important differences between the two drugs is the fact that penicillin can exert its bactericidal effect without the aid of phagocytosis. This is the most likely reason for its success. The aid of the absent polymorphonuclear cells is not required by penicillin, while it is required by the other drugs. Perhaps another reason for the failure of the sulphonamides is that they are inactivated by tissue debris, of which there is a considerable amount in the vegetation.

The long period of treatment with a fairly high blood concentration which has now been shown to be necessary for successful treatment of subacute bacterial endocarditis, is indirect evidence that there can be but little penetration of the vegetation by penicillin; nor can it reach the organisms via the capillaries of the vascularized valve. The drug probably kills off the most superficial bacteria, a certain amount of healing takes place, and more organisms are exposed to its action. In the process of healing it is inevitable that the valve will be damaged; the final picture depends on the amount of damage, if any, which existed before.

There is still much to be learnt about the pathogenesis of this disease; but from the experimental and clinical evidence up to date it is possible that, following a shower of organisms into the blood stream, the bacteria are taken up and dealt with by the endothelial cells. In cerain places in the heart, however, they are not adequately dealt with—for instance, where there is any break in continuity in the endocardium, such as may be present at the platelet thrombi of Grant and also in those places where the endocardial cells and the subjacent structures have been previously damaged. The organisms gain a foothold at these points. In the case of the more virulent organisms, by reason of their ability to invade tissues, this foothold is gained more readily than by the less virulent organisms, and so the pyogenic cocci attack normal valves more frequently than does the *Streptococcus viridans*. Once the organisms are established, a layer of fibrin is deposited over them, in which they can grow readily, and in which the organisms of low virulence produce actual colonies that are able to protect themselves against the body's antibacterial defences. By further destruction of the valve and deposition of blood elements, a vegetation is formed. In the case of the virulent organisms the patient dies because of the invasive character of the organism, and in the case of organisms of low pathogenicity, the patient usually dies from the effects of emboli.

Conclusion.

The important thing which emerges from this review is that, although we now have a powerful weapon against this formerly fatal disease, there is still need for further investigation. To the points which Dr. Halliday stressed—that is, accurate and early diagnosis and the need for prophylaxis in the case of potentially susceptible people—one must add that there is the need for more careful study of the causative organism as regards both its accurate identification and its sensitivity to penicillin.

Finally, further investigation of the factors involved in valve susceptibility and of the pathogenesis of the disease is still necessary. Penicillin will cure only the inflammatory lesion on the valve, and the patient is left with the result of those vegetations—a deformed valve, impaired cardiac efficiency and perhaps damage to distant organs such as the brain and kidney from which he may eventually die. Dramatic though penicillin treatment is, one must not lose sight of the fact that prevention is better than cure.

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THE EFFECT OF CEREBRO-SPINAL FLUID ON THE INTERACTION BETWEEN Rh AGGLUTININS AND AGGLUTINOGENS.

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IN view of the pronounced effect of human serum, when used instead of saline solution as a diluent, on the interaction between anti-Rh serum and appropriate red cells (Wiener's "conglutination" test),[1] an experiment was carried out to determine what would be the effect of using human cerebro-spinal fluid as the diluent in such tests.

First Experimental Investigation.

Experiments were made with six different anti-Rh sera, all of which had been inactivated by heating to 56° C. for twenty minutes. Two series of tests were set up. In one, appropriate dilutions of these specimens of serum and the red cell suspensions were made with isotonic (0·85%) saline solution. In the other series, both serum dilutions and cell suspensions were made with cerebro-spinal fluid. In all fifteen samples of cerebro-spinal fluid were used, eight of which were sufficient in quantity to test with all six specimens of serum, the others with not less than three specimens of serum.

Red cells from the same individual classified as group O Rh$_1$ (Wiener's nomenclature) Hr-negative were used in all tests. The cell suspensions in either saline solution or cerebro-spinal fluid were of 2% strength in terms of blood sediment, the final dilution in the tests being 1%. The specimens of serum used were diluted to an extent which (as determined by preliminary tests) gave the best combination of strong agglutination with saline suspensions of red cells, together with the overcoming of any blocking antibody if present and with the demonstration of the effect of cerebro-spinal fluid. When the optimum dilution to fulfil these three criteria had been determined for each individual specimen of serum, tests were made by mixing in small test tubes of approximately eight millimetres' diameter, 0·1 millilitre of the appropriate dilution of each serum sample in both saline solution and cerebro-spinal fluid. These mixtures were incubated for two hours at 37° C. and then 0·1 millilitre amounts of the red cell suspensions in saline solution and in cerebro-spinal fluid respectively were added to their corresponding serum dilutions. Readings were taken macroscopically after two hours' incubation at 37° C. with the aid of a hand lens in doubtful cases.

The samples of cerebro-spinal fluid used were obtained through the courtesy of Miss B. Splatt and Dr. S. G. Anderson from patients at either the Royal Melbourne Hospital or the Children's Hospital. All those used in the tests had protein and chloride content within the range of normality.

The clinical histories of the women from whom the specimens of anti-Rh serum were obtained are as follows.

Mrs. C.A., who has been pregnant four times, has two living full-term children and had one miscarriage at three months. Her last pregnancy (1942) resulted in the normal delivery of a full-term child, who developed *icterus gravis* and died. At autopsy, *erythroblastosis fœtalis* was found. The brain was congested, and yellow staining of the basal ganglion and nuclei of the cerebellum was present.

Rh antibodies of high titre were first detected in Mrs. C.A.'s serum when she volunteered as a Red Cross donor eight months after the death of her baby. The titre has remained high ever since, and Mrs. C. A. has made several donations of blood. The sample of her serum used in the tests described in this paper was taken early in 1945.

Mrs. S.P. has been pregnant nine times and has seven living children. Her eighth pregnancy (1944) resulted in the birth of twins, both affected by *icterus gravis*; one died. Her ninth pregnancy resulted (August 15, 1945) in the birth of a full-term child, who developed *icterus gravis* and severe anæmia, but gradually recovered after several blood transfusions. The child's blood was group O Rh-positive.

Mrs. S.P. had strong Rh agglutinins at delivery (titre 64). The titre rose to 4,000 one week after delivery, but fell to 2,000 during storage, and was at the latter strength when used in the tests described in this paper.

Mrs. C.U. has been pregnant three times. She has had one normal full-time child and one miscarriage four years ago. Her last pregnancy resulted in the normal delivery on April 19, 1945, of a full-term baby, who developed severe anæmia, had several blood transfusions and progressed satisfactorily. The child's blood was group A, Rh-positive, and the maternal serum contained strong Rh antibodies at delivery.

The serum used in this investigation was obtained during the second week after delivery.

Mrs. F.L. has been pregnant five times. She has had one normal child, two miscarriages at three months, and one living child who on the third day developed jaundice which lasted for six weeks. The fifth pregnancy terminated on March 5, 1944, in the birth of a full-term child, who developed jaundice very rapidly. The baby was given numerous blood transfusions, but later head retraction and spasm of arms developed, and the baby died of bronchopneumonia at the age of nine months. The child's blood was group O Rh-positive. The maternal serum had strong antibodies at delivery.

The sample used in this investigation was obtained after delivery.

Mrs. O.R. had been pregnant four times, and had had two normal full-term children and one miscarriage at three months. The outcome of the last pregnancy was a living child, who died four hours after birth on November 25, 1944. At the autopsy *erythroblastosis fœtalis* was found.

The serum used was obtained after delivery.

Mrs. U.P. had been pregnant twice. The first child was normal. The second child was pale but not jaundiced at birth (in 1944). The child became increasingly jaundiced from the second day, had several blood transfusions and recovered. The child's blood group was O, Rh-positive. The maternal serum contained Rh antibodies at delivery.

The sample used was obtained about seven days after delivery.

Results of Experiments.

The results obtained in the first series of experiments are shown in Table I. It will be seen that dilution with cerebro-spinal fluid completely inhibited the action of the anti-Rh agglutinins of three specimens of serum, SP, CU and FL, and almost completely did so in the case of serum UP. In the other two specimens (CA and UP) incomplete inhibition occurred.

The results shown in Table I were obtained with unheated cerebro-spinal fluid. Identical results were obtained with three samples of cerebro-spinal fluid which had been heated, one to 56° C. for thirty minutes, one to 62° C. for thirty minutes, and one to 100° C. for five minutes.

Second Series of Experiments.

A second series of experiments has been carried out, as follows.

1. After readings had been taken as described above, the tubes in which cerebro-spinal fluid had been used as diluent were spun, and the supernatant fluid was removed. The cell sediments were then resuspended in the same specimens of anti-Rh serum, diluted to the same degree as in the original experiment, but with saline solution instead of cerebro-spinal fluid. After two hours' incubation strong agglutination was observed. The agglutinability

TABLE I.
Agglutination of Group O Rh_1 Cells by Anti-Rh Serum.

Serum.	SP. (Serum Dilution 1/20.)	CU.[3] (Serum Dilution 1/10.)	FL. (Serum (Dilution 1/5.)	CA. (Serum Dilution 1/5.)	OR. (Serum Dilution 1/10.)	UP. (Serum Dilution 1/10.)
	Group A, Anti-Rh_2; Titre 2,000.[1] No Blocking Antibodies.[2]	Group A, Anti-Rh_1; Titre 250. Blocking Antibodies. (Trace.)	Group O, Anti-Rh_2; Titre 120. Blocking Antibodies. (+.)	Group A, Anti-Rh_2; Titre 500. No Blocking Antibodies.	Group A, Anti-Rh_2; Titre 250. No Blocking Antibodies.	Group O, Anti-Rh_2; Titre 64. Blocking Antibodies. (++.)
A. Agglutination with saline solution as diluent	++++[4]	+++	++	++++	+++	+++
B. Agglutination with cerebro-spinal fluid as diluent from persons belonging to the following blood groups:						
1. Group AB, Rh+	Nil	Nil	Nil	Not tested	Not tested	Not tested
2. Group AB, Rh+	Nil	Nil	Nil	+	+	Nil
3. Group A, Rh+	Nil	Nil	Nil	Not tested	Not tested	Not tested
4. Group A, Rh+	Nil	Nil	Nil	++	++	Not tested
5. Group A, Rh+	Nil	Nil	Nil	++	+	Trace
6. Group A, Rh+	Nil	Nil	Nil	++	Nil	Nil
7. Group O, Rh+	Nil	Nil	Nil	Not tested	Not tested	Not tested
8. Group O, Rh+	Nil	Nil	Nil	++	++	Trace
9. Group O, Rh+	Nil	Nil	Nil	++	Not tested	Not tested
10. Group O, Rh+	Nil	Nil	Nil	+++	+++	Nil
11. Group AB, Rh−	Nil	Nil	Nil	++	+	Nil
12. Group A, Rh−	Nil	Nil	Nil	+	+	Not tested
13. Group B, Rh−	Nil	Nil	Nil	+	±	Not tested
14. Group O, Rh−	Nil	Nil	Nil	+	+	Nil
15. Group O, Rh−	Nil	Nil	Nil	++±	+±	Nil

[1] Titre: Reciprocal of greatest dilution of serum which causes agglutination of the Rh_1 test cells after sixty minutes at 37° C., when serum dilution and red cell suspensions are both made up in saline solution.
[2] Blocking antibodies: The approximate strength of the blocking antibody is shown in brackets. The dilutions used of the specimens of serum in which blocking antibodies were present were sufficient to eliminate the effect of these antibodies in respect of agglutination of saline suspensions of red cells.
[3] Serum CU contained anti-Rh' agglutinins only to a titre of 2, so that in the 1 in 10 dilution used in these tests it behaved as an anti-Rh_2 serum.
[4] Relative strength of agglutination recorded as "++++", "+++", "++" or "+" if visible without hand lens, and "trace" if just visible with lens.

of the cells, therefore, had not apparently been affected by the cerebro-spinal fluid, so that it would appear that the latter interfered with some component of the serum.

2. Four specimens of serum (SP, CU, FL and OR) were diluted as before with both cerebro-spinal fluid and saline solution and allowed to stand for two hours at 37° C. Cell suspensions were made up in saline solution, in cerebro-spinal fluid, in undiluted human serum, in 25% human albumin solution and in rabbit globulin. These cell suspensions were added as in the original experiment to the two series of serum dilutions, and readings were taken after a further two hours' incubation at 37° C. The results obtained, shown in Table II, indicate that the inhibitory effect of cerebro-spinal fluid is partially counteracted by the addition of human serum and wholly by the addition of albumin under the conditions used in this experiment.

3. The addition of 0·1 millilitre of human serum to the mixture of serum and cells in cerebro-spinal fluid in which complete inhibition has been demonstrated, caused the reappearance of agglutination (Table III). This indicates that even the complete inhibition of agglutination brought about by the use of cerebro-spinal fluid for diluent both for serum and for cell suspensions is, to a certain degree, reversible.

4. "Artificial cerebro-spinal fluid" was prepared in the following two ways. The first form contained the following mixture of salts in 100 millilitres of distilled water (that is, the chief electrolyte constituents only): chlorides (as NaCl), 0·72 gramme; phosphates (as $Na_2H\ PO_4\ (2H_2O)$), 0·002 gramme; calcium (as $CaCl_2\ (H_2O)$), 0·006 gramme. The second form contained a similar mixture of salts together with the following organic components: protein, 0·03 gramme; glucose, 0·1 gramme; urea, 0·02 gramme. Neither of these mixtures inhibited Rh agglutination by specimens SP, CU, OR, CA, FL or UP.

5. In view of the chemical similarity between human cerebro-spinal fluid and allantoic fluid of the chick embryo, the possible effect of the latter on Rh agglutination was tested. No inhibitory action could be demonstrated.

6. Cerebro-spinal fluid of a Rhesus monkey and of a rabbit were used as diluents. Both produced an inhibitory effect similar to that of human cerebro-spinal fluid on Rh agglutination, but like human cerebro-spinal fluid, did not inhibit human A or B agglutination.

The results of the experiments described in paragraphs 4, 5 and 6 above are shown in Table IV.

It is to be noted that the effect of cerebro-spinal fluid was nullified by agents such as human serum or albumin, which are also those which appear to convert Rh blocking antibodies into agglutinins. It was considered possible, therefore, that the action of cerebro-spinal fluid might be to convert an agglutinating antibody into a blocking antibody.

7. To explore this hypothesis, tests were set up with a serum (ME) containing strong blocking and agglutinating

TABLE II.
Agglutination Obtained with Cells Suspended in Various Media.

Medium in which Cells Suspended.	Serum Diluted with Normal Saline Solution.		Serum Diluted with Cerebro-spinal Fluid.				
	SP.	CA.	SP.	CA.	CU.	FL.	OR.
Cerebro-spinal fluid	+	++	Nil	+	Nil	Nil	++
Normal saline solution	++++	+++	Nil	+	Nil	Nil	+++
Serum	++++	+++	++	+++			
Albumin (25%)	++++	++++	++++	++++	++++	++++	++++
Globulin			Nil				

antibodies, the latter reacting with both Rh_0 and Rh′ antigens. In the first series of experiments (Table I) the specimens of serum were deliberately tested in a dilution in which the blocking effect was overcome; but in this experiment a serum ME containing strong blocking antibodies was tested in a range of dilutions from full strength to the end point of its titre. The results are shown in Table V, and their interpretation is discussed below.

TABLE III.

Restoration of Rh Agglutination (Inhibited by Cerebro-Spinal Fluid) by Addition of Human Serum.

Dilution.	Serum Diluted in Cerebro-spinal Fluid.		
	SP.	CA.	CU.
Cells diluted in cerebro-spinal fluid	Nil	+	Nil
Serum added afterwards ..	++	+±	++
Control—			
Serum and cells diluted in normal saline solution ..	++++	++	+++

Discussion.

It is obvious that normal cerebro-spinal fluid interferes with the conditions necessary for the interaction between Rh agglutinogens and agglutinins as usually demonstrated *in vitro*. However, different specimens of anti-Rh serum are not affected to the same degree. This suggests that the observed inhibition of agglutination is, in part at least, due to a variable factor in the different specimens of serum, since each of the fifteen samples of cerebro-spinal fluid used reacted similarly in respect of individual specimens of serum (with the possible exception of cerebro-spinal fluid sample number 6, which was the only one of those tested which caused complete inhibition of agglutination by serum OR).

The effect of cerebro-spinal fluid appears to be related only to the Rh antigen-antibody reaction, since it has been shown that cerebro-spinal fluid does not contain A or B group-specific substances.[2] However, it cannot be attributed to analogous Rh receptor substance, since five of the fifteen specimens of cerebro-spinal fluid were from Rh-negative and ten from Rh-positive subjects.

Chemical composition, as such, does not appear to be the determining cause of the action of cerebro-spinal fluid, since the closely similar allantoic fluid and the artificial cerebro-spinal fluid do not react in the same way. Neither is it a species-specific reaction, since cerebro-spinal fluid from a Rhesus monkey and a rabbit behave similarly to human cerebro-spinal fluid.

A small series of specimens of abnormal cerebro-spinal fluid with protein content varying from 35 to 120 milligrammes *per centum* have also been tested, with results similar to those obtained with normal fluid. One sample of cerebro-spinal fluid was obtained shortly after death from a baby who died with kernicterus. Results with this sample, however, are not considered valid, as it was bacterially contaminated and caused hæmolysis of the cell suspension. So far no other samples of cerebro-spinal fluid from similar cases have been available.

It was thought possible that maternal serum taken at or shortly after delivery (for example, as in the cases of SP and CU) might differ in composition from that obtained at long intervals after delivery; but of the two specimens of serum which are not completely inhibited by cerebro-spinal fluid, one (CA) was obtained approximately three years after the affected child was born, and the other (OR) a few days after delivery. All those in which inhibition occurred, on the other hand, were obtained at or shortly after delivery.

While the nature of the action of cerebro-spinal fluid is so far not fully elucidated, there is evidence that it has some relation to the so-called blocking phenomenon, since the "interfering" effect of cerebro-spinal fluid and the action of blocking antibodies can be overcome by the same agents. Further, in the case of anti-Rh serum such as ME (described in this paper), which contains both anti-Rh_0 and anti-Rh′ agglutinins, cerebro-spinal fluid interferes only with the Rh_0 antibody, which in the large majority of reported cases is the only one associated with the blocking phenomenon; the exceptions are in the cases reported by Diamond and Denton.[3] It is to be noted, however, that cells treated with blocking antibody are not

TABLE IV.

Comparison of the Effect of Human Cerebro-spinal Fluid and other Substances on Rh-Agglutination.

Diluent Used for Cell Suspensions and Serum Dilutions.	Anti-Rh Serum.					
	SP.	CU.	FL.	CA.	OR.	UP.
Saline solution	++++	+++	++	++++	+++	+++
Artificial cerebro-spinal fluid—						
(*a*) Electrolytes only	++++	+++	++	++++	+++	+++
(*b*) Electrolytes and organic substances	++++	+++	++	++++	+++	+++
Allantoic fluid of chick	++++	+++				
Rhesus cerebro-spinal fluid (sufficient for one test only)	Nil					
Rabbit cerebro-spinal fluid (sufficient for one test only)	Nil					
Human cerebro-spinal fluid	Nil	Nil	Nil	+	±	±

TABLE V.

Relationship of Effect of Cerebro-spinal Fluid to Blocking Antibodies.

Diluent for Cells and Serum.	Rh Subtype of Cells Used.	Final Dilutions of Anti-Rh_1 Serum ME (Group AB).										
		1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	1/512	1/1024	1/2048
Human serum	Rh_1 (RhO′)	++++	++++	++++	++++	++++	++++	++++	+++	++	+	Nil
	Rh_2 (RhO″)	++++	++++	++++	++++	++++	++++	++++	+++	++	+	Nil
Saline solution	Rh_1 (RhO′)	+++	+++	+++	+++	++++	++++	++++	+++	+	Trace	Nil
	Rh_2 (RhO″)	Nil	Nil	Nil	Nil	++	++	++++	++	+	Trace	Nil
	Rh′ (Rh′)	+++	+++	+++	+++	+++	+	Nil	Nil	Nil	Nil	Nil
Cerebro-spinal fluid	Rh_1 (RhO′)	+++	+++	+++	+	+	Nil	Nil	Nil	Nil	Nil	Nil
	Rh_2 (RhO″)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Rh′ (Rh′)	++++	+++	++	+	+	Nil	Nil	Nil	Nil	Nil	Nil

subsequently agglutinable, whereas those which have been subjected to the action of cerebro-spinal fluid may later be agglutinated by suitable anti-Rh serum.

The phenomenon we have described will probably be elucidated only when the nature of blocking antibodies is understood. Essentially the blocking phenomenon probably means that Rh_0 antibody is a labile globulin molecule which can maintain its fully functional configuration only in solution with an adequate concentration of albumin. When this concentration is reduced below a certain level a new configuration must be taken up, and it is reasonable to suppose that minor factors, such as the presence of even the heat-stable cerebro-spinal fluid agent, may alter the character of the new configuration. If other types of Rh antibody show something of the same lability and change of configuration on dilution in saline solution, it is also to be expected that the cerebro-spinal fluid agent may make more evident what is only a potential or trivial effect in saline solution alone. Further studies on the nature of the cerebro-spinal fluid agent are in progress.

Summary.

1. Three specimens of human serum containing strong anti-Rh agglutinins did not agglutinate group O Rh$_0$ cells when chemically normal cerebro-spinal fluid was used (instead of saline solution) as the diluent for the serum dilutions and the red cell suspensions. Similar results were obtained (and in some cases repeatedly confirmed) with fifteen different samples of cerebro-spinal fluid. A fourth specimen of anti-Rh serum was inhibited by six of the fifteen cerebro-spinal fluid samples and almost completely by two. There was insufficient cerebro-spinal fluid from the remaining seven samples to carry out tests with this serum.

2. Two anti-Rh sera were partially inhibited by the use of cerebro-spinal fluid as a diluent, but gave some agglutinations with each of the fifteen samples of cerebro-spinal fluid tested.

3. The inhibition occurred irrespective of whether the subjects from whom the samples of cerebro-spinal fluid were obtained were Rh-positive or Rh-negative.

4. Exposure to cerebro-spinal fluid does not destroy the agglutinability by anti-Rh serum of Rh-positive red cells, as they can subsequently be agglutinated when removed from contact with cerebro-spinal fluid.

5. The inhibition of Rh-agglutination by cerebro-spinal fluid can be overcome by the addition of human serum or human albumin.

6. Artificially prepared fluids containing the main known chemical components of cerebro-spinal fluid do not mask Rh-agglutination, nor does the chemically similar allantoic fluid of the chick embryo.

7. Cerebro-spinal fluid from one Rhesus monkey and one rabbit had a similar effect on human Rh-agglutination, as did fifteen samples of human cerebro-spinal fluid which were chemically normal or had a protein content ranging from 35 to 120 milligrammes per 100 millilitres.

8. The factor in cerebro-spinal fluid causing inhibition of Rh-agglutinins was not destroyed by heating to 56° C. or 62° C. for thirty minutes, or by boiling for five minutes.

9. Some experiments suggest a relationship between the action of cerebro-spinal fluid and the blocking phenomenon.

Acknowledgement.

We wish to thank Professor F. M. Burnet for his interest and helpful criticism of this paper.

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Reports of Cases.

THE FAILURE OF PENICILLIN AND DIRECT BLOOD TRANSFUSION IN THE TREATMENT OF ACUTE LEUCHÆMIA.[1]

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ACUTE LEUCHÆMIA with its rapid febrile course often gives clinically the impression of an acute fulminant infectious disease. All therapeutic attempts with arsenic, deep X rays or other remedies fail. Attempts were made to stem the course of the disease with penicillin. As the anæmia is an outstanding sign, the penicillin therapy was augmented by direct blood transfusion with an instrument permitting fresh blood from the donor's vein to run without anticoagulant into the patient's vein. As in numerous previous cases, complications with abnormal serum reactions were encountered after the initial transfusion had been successfully given, so that the blood transfusions had to be discontinued. The penicillin used was "Penicillin Commonwealth", made by the Commonwealth Serum Laboratories in Melbourne.

Case I.

The first patient, a woman, aged thirty-six years, came to hospital with a history of a sore throat, sore gums and fever of ten days' duration. The spleen was just palpable under the left costal margin; the hæmoglobin value was 7·3 grammes *per centum*, the erythrocytes numbered 3,800,000 per cubic millimetre, and the leucocytes numbered 122,000 per cubic millimetre, 72% being primitive myeloblasts. Platelets were scanty, and a few normoblasts were present in the peripheral blood. The diagnosis of acute myeloblastic leuchæmia was made and confirmed by sternal puncture, and a blood transfusion of two pints was given at once. On the same day penicillin therapy was begun; the patient received 25,000 units every four hours. However, her temperature went from 100° F. to 102° F. After twenty-four hours the blood examination was repeated. The hæmoglobin value was 7·8 grammes *per centum*, and the leucocytes numbered 522,000 per cubic millimetre, 23% being polymorphonuclear cells and 77% primitive myeloblasts. There were fewer platelets and more normoblasts in the peripheral blood. A further pint of blood was given by transfusion. After forty-eight hours the patient's gums were much more spongy; the temperature stayed up at 102° F. The hæmoglobin value was 7·1 grammes *per centum* and the leucocytes numbered 840,000 per cubic millimetre, 4% being normoblasts, only 14% polymorphonuclear cells and 72% myeloblasts. The patient died from multiple hæmorrhages on the third day, the hæmoglobin value being 7·1 grammes *per centum*; the leucocytes in the peripheral blood then numbered 670,000 per cubic millimetre, 5% being normoblasts, 3% polymorphonuclear cells and 92% myeloblasts.

At the post-mortem examination the diagnosis of acute myeloblastic leuchæmia was confirmed. Typical lesions were found in the bone marrow of the ribs, sternum, vertebræ, liver and spleen. Only two lymph nodules in the region of the neck were found to be enlarged. The gums were spongy, but had not ulcerated. The total amount of penicillin given in three days was 425,000 units. At no stage did the penicillin give the impression of relieving the symptoms, nor did the transfusion of three pints of blood alter the course of the disease.

Case II.

A man, aged forty-five years, with a history of loss of energy and sore throat of two weeks' duration, came to hospital complaining of difficulty in swallowing. The patient had noticed loss of weight and a pronounced pallor. On examination, he had a temperature of 101° F., fœtid

[1] Work done with the aid of the Anti-Cancer Campaign, University of Adelaide.

breath, and ulcers on both tonsils, covered with patches of a greyish slough. The submaxillary and submandibular lymph nodules, as well as the group of lymph nodules anterior to the *musculus sterno-cleido-mastoideus*, were enlarged. The spleen could not be felt, but the liver was enlarged. The hæmoglobin value was 4·68 grammes *per centum;* the leucocytes numbered 212,000 per cubic millimetre. A transfusion of two pints of fresh blood was given at once, and penicillin therapy was started. The patient received 15,000 and 20,000 units every three or four hours. The temperature on the following days was swinging between 101° F. in the morning, and 97° F. in the afternoons. The hæmoglobin value began to fall below 4·6 grammes *per centum* after twenty-four hours, but was kept up with two pints of blood by direct transfusion. On the eighth day the transfusions had to be discontinued, the patient becoming comatose after he was given 50 millilitres of blood. The number of leucocytes varied from 300,000 to 181,000 per cubic millimetre on the first and eighth day. The differential count revealed a steady decrease of granulocytes, which numbered only 2% on the eighth day, and a steady rise in the normoblasts from 1% to 31% on the eighth day, the rest of the cells being large primitive monoblasts. The platelets were always scanty. The patient died from hæmorrhages on the ninth day in hospital, after eight days' continuous penicillin treatment.

At post-mortem examination the typical lesions of acute monocytic leuchæmia were found in lymph nodules, liver, spleen and pharynx. The total dose of penicillin given intramuscularly over this period was 945,000 units. At no stage during the nine days in hospital did the penicillin therapy or the transfusion of four pints of blood give the impression of altering the course of the leuchæmia.

Case III.

A well developed, athletic young man, aged sixteen years, with a history of a sore throat and lymph nodular swelling in the neck, who was very pale and whose temperature was 104° F., came to hospital with the diagnosis of acute leuchæmia. On examination, he had enlarged tonsils and lymph nodules in the neck, enlarged liver and palpable spleen, and he had great difficulty and pain in swallowing hard food. The hæmoglobin value was 11·7 grammes *per centum*, and the leucocytes numbered 12,500 per cubic millimetre, 2% being monoblasts, 20% lymphocytes and 78% primitive cells. A sternal puncture excluded glandular fever and established the diagnosis of acute leuchæmia with agranulocytosis. A direct transfusion of one pint of blood was given, and intramuscular penicillin treatment was commenced with an initial dose of 100,000 units and continued with 60,000 units every four hours. After twenty-four hours the temperature had not altered and the first subcutaneous and retinal hæmorrhages appeared. The hæmoglobin value dropped to 10·14 grammes *per centum*, and the number of leucocytes was reduced to 600 per cubic millimetre. The differential count revealed complete agranulocytosis with an output of primitive cells. A further direct transfusion of one pint of blood was given. After forty-eight hours the hæmoglobin value was 10·6 grammes *per centum*, the temperature still remaining at 104° or 105° F. The leucocytes numbered 600 per cubic millimetre and the hæmorrhages into the skin and retina increased. Two days later another direct transfusion of one pint of blood was given. In spite of the transfusion, the hæmoglobin value was only 9·0 grammes *per centum*, and the leucocytes numbered 2,000 per cubic millimetre, complete agranulocytosis and an output of primitive cells being found. On the following day a further attempt at direct blood transfusion had to be abandoned, because the patient had a severe rigor shortly after the start. The hæmoglobin value fell to 8·58 grammes *per centum;* the leucocytes numbered 2,000 per cubic millimetre, agranulocytosis persisting. On the following morning the patient died from internal hæmorrhage into his lung.

At post-mortem examination enlarged tonsils and enlarged lymph nodules of the neck, axilla and groin, enlarged liver, enlarged spleen and brownish bone marrow were found. There was an area of ulceration in the œsophagus three inches long, just above the cardia.

The penicillin treatment was continued from the first day onwards. The total amount the patient received over four days was 1,900,000 units. At no time during his illness did penicillin or the direct transfusions (three pints and 50 millilitres of blood) noticeably alter the clinical course of the acute leuchæmia.

Summary.

Direct blood transfusions in acute leuchæmia were only of very limited value. They relieved the symptoms of anæmia and hæmorrhages only for a few hours, if at all.

Intramuscular treatment with penicillin (in doses up to 1,900,000 units given in four days) had no effect on the course of acute leuchæmia.

Therapeutic attempts with penicillin and direct blood transfusion should be abandoned in cases of acute leuchæmia, as they are a source of trouble and inconvenience to the patient.

Reviews.

MEDICAL EMERGENCIES.

IT is a pleasure to have to review such a useful little book as "Medical Emergencies" by Charles Newman, the third edition of which now appears.[1] This is a book which should be in a handy position on every doctor's shelf, for no matter what may be the type of practice he is engaged in, every medical man is at some time or another faced with a medical emergency, which usually must be quickly resolved, if it is to be in the patient's favour. A brief but pertinent description of the symptoms caused by all types of poisons is given, and short dogmatic instructions are stated to counteract the poisons' effects. A useful list of the dosages required for the administration of the sulphonamides and penicillin is given, and this will prove helpful to a specialist treating an emergency not related to his own speciality. The "medical operations" of venesection and blood transfusion are well described, but the instructions for blood typing would have been much plainer had they been printed in tabular form. The sole surgical operation dealt with is that of tracheotomy, and as this usually finds its application in an acute emergency, its inclusion is not out of place. The author wisely exhorts no one to administer morphine in the presence of abdominal pain unless the doctor giving it intends to operate himself; all surgeons will agree with him in this, for nothing can be more upsetting for a consultant than to find when he arrives that the patient is under the soothing influence of an opiate. Mention cannot be made of all the various emergencies covered in this book, but it is sufficient to say that although it is necessarily brief, it is nevertheless complete.

THE PRINCIPLES OF ANATOMY.

THE first edition of "The Principles of Anatomy" was produced hurriedly to meet an emergency, and so in preparing the second edition, the author has carefully revised the text and considerably extended its scope.[2] The book preserves its original aim of affording an introduction to the study of man as a biological problem in relation to his environment, and careful revision has effected much improvement both in text and in illustrations. In recent years some schools have revised their medical curricula, reducing somewhat the time allotted to biology and human anatomy, and so there is a demand for some such work as this. The description of each system of the body is opened with a statement of the problem to be solved, and this is followed by a description of the apparatus evolved for the purpose, and a short statement of how the apparatus works. Several new chapters have been added, including four on various aspects of the anatomy of reproduction and a short history of anatomy. Appendices supply information about the dimensions and weights of the various viscera in the adult and a glossary of terms used in anatomy. On the whole, this work is a very useful and stimulating introduction to the study of human anatomy and prepares the way for the more detailed work in the dissecting room.

[1] "Medical Emergencies", by C. Newman, M.D. (Cantab.), F.R.C.P. (London); Third Edition; 1946. London: J. and A. Churchill Limited. 8" × 5¼", pp. 128. Price: 10s. 6d.

[2] "The Principles of Anatomy: An Introduction to Human Biology", by A. A. Abbie, M.D., B.S., D.Sc. (Sydney), Ph.D. (London); Second Edition; 1946. Sydney, London: Angus and Robertson Limited. 8¼" × 5¼", pp. 374, with many illustrations. Price: 12s. 6d.

The Medical Journal of Australia

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PSYCHIATRY AND PSYCHIATRISTS.

In a discussion on the future of psychiatry in Australia in these columns a little more than a year ago the question was asked whether psychiatrists were being given enough opportunities to advance their knowledge and to be of the greatest possible use to the community and to their profession. The suggestion was made that if a "special group" of psychiatry was formed within the ambit of the British Medical Association in Australia, psychiatrists would be in a position to exchange their views on the prevention and cure of mental disease in a way that is impossible to them at present. It is with some satisfaction, therefore, that we are able to record the formation of the Australasian Association of Psychiatrists at an inaugural meeting in Melbourne on October 9, 1946. It is perhaps unfortunate that the new organization was not formed as a "special group" as part of the British Medical Association, but the inclusion of members from New Zealand made this impossible. Though members of the British Medical Association in Australia wish to see their association strengthened from every possible point of view by the inclusion *inter alia* of special groups of all the specialties, they will recognize the value of a scientific body that includes both the Commonwealth and the Dominion of New Zealand. What really matters is that psychiatrists in this part of the world have banded themselves together in the pursuit of knowledge. This event is of value to the whole medical profession, first of all because the attainment of a high standard by psychiatrists will make available to the whole profession a reliable opinion and efficient treatment in mental disease, and also because a body of psychiatrists seeking knowledge will necessarily concern itself with the teaching of undergraduate students and their training in the essentials of psychiatry. The truth of this last statement is evident from the address, published in this issue and delivered at the inaugural meeting by Professor W. S. Dawson, the first president of the Australasian Association of Psychiatrists.

As the boy is the father of the man, so the undergraduate medical student is the father of the practitioner. If the undergraduate learns what psychiatry means—its range and its significance—he will have gone a long way towards solving many of the difficult problems that he will have to face in his later years as a practitioner. It may be useful to quote again the range of psychiatry as described by Gregg in the *British Medical Journal* of April 22, 1944. He remarked that it covered "the conduct of man, his reactions, his behaviour as an indivisible sentient being with other such beings". Gregg also wrote: "it reaches into the anxieties, the fatigues, the instabilities, the adjustments, the disturbance of normal everyday living . . . it includes the effects of mental and emotional functions upon the component organs of the body as well as the effects of disorders of these organs upon the functions of the human being as a whole." In view of this definition we shall agree with the compilers of the Goodenough Report that the better the doctor, the more attention he pays to the psychological background. It is also true, and obvious to onlookers who have any medical training, that doctors who preface all their treatment with an attempt to discover the mental factor in an illness are much more successful in the long run than the clinician who ignores this factor. We may therefore conclude that training of practitioners in psychiatry must begin in the undergraduate days, and, like training in any other branch of medicine, must be continued throughout professional life.

Professor Dawson has discussed the type of teaching that should be given to undergraduate students. But clearly the new association will concern itself also with the dissemination of psychiatric knowledge among practitioners. This concern of the association is thus typical of the relationship of psychiatry to the whole of medicine. The association will have another relationship—that dealt with by Professor John Bostock in his article, a relationship with the community. This is after all part of the first relationship, because it may be included in the subject of sociological medicine.

To carry out the threefold yet single object of their association Australian psychiatrists will need to have not only a belief in the importance, the righteousness, of their mission, but ready access to students and practitioners in teaching centres and a sense of optimism, a feeling that they will succeed. They must try to show that Sir L. G. Brock was mistaken in the views expressed by him in the twentieth Maudsley Lecture, published in *The Journal of Mental Science* of April, 1946. Brock thinks that pessimism is one of the salient characteristics that distinguish psychiatrists from other specialists in medicine. It should perhaps be explained that Brock is a layman who has for many years been associated officially with the mental hospital service in Great Britain. There is no need to discuss his views in any detail, but it may help our argument to refer to his idea that entanglement with the law is one of the reasons for the pessimism that he sees. The fact that restrictions, necessary in the patient's interest and sometimes in the interest of the public, cannot be imposed without the authority of a lay justice, "perpetuates an attitude of suspicion which prejudices the relation of the patient and the doctor". There is also a reaction on the general public. Brock thinks that entanglement with the law makes psychiatrists feel that they do not enjoy the confidence of the public to the

same extent as other branches of the profession. This puts them on the defensive and, he believes, tends to emphasize the isolation in which many psychiatrists live. This isolation is fostered by the remoteness of many mental hospitals and by the ignorance of psychological medicine on the part of many medical practitioners. The Goodenough Report, it should be remarked, also drew attention to the psychiatrists' lack of prestige in the medical profession in comparison with that possessed by other practitioners of consultant status.

If psychiatrists do suffer from the effects of isolation the fact must be credited to the mental hospital practice and the general outlook of bygone years. The starting of the new association of psychiatrists will itself help to overcome any outmoded relic of the past. Another event which will make of psychiatry the powerful agent in medical practice that it should be is the growing tendency to incorporate departments of psychiatry in present-day general hospitals. Professor Dawson shows that mental hospitals must be associated with general teaching hospitals. If students are to have first-hand experience in the examination of mental patients they must have clinical access to them. It was for this reason that the Goodenough Report declared that in future a medical training centre could not be regarded as making proper provision for the training of medical students until it had an active department of psychiatry, the work and teaching of which were interwoven with the work and teaching of other departments. The creation of these departments, where they do not yet exist, is not something that can be done overnight. If they are built up slowly the building up is likely to be sure. The experience gained by medical officers with the services in the war will at least be an incentive to such work where it is not enthusiastically carried out at present. The truth of the matter is that many more psychiatrists are needed. The practice of medicine outside mental hospitals needs more psychiatrists, and teaching hospitals specially will need additions to their staffs if the enormous numbers of students crowding the medical schools are to receive anything like adequate teaching. Teaching must be adequate. At present there is current among intelligent people an idea that psychiatry can be used, especially in the law courts, to excuse abnormal or criminal conduct. This is a pernicious idea. To find an explanation for an act does not necessarily remove responsibility for its commission. To hold such a view is to suggest that trained understanding and experience must be denied the virtue of common sense. When teaching is adequate this cannot happen. Taking as a whole the subject of psychiatry in relation to medicine and the community, we may predict for the Australasian Association of Psychiatrists a future full of opportunity for usefulness.

Current Comment.

SUDDEN DEATH IN RHEUMATIC FEVER.

RHEUMATIC HEART DISEASE has been studied backwards, like many other morbid processes; that is, the later results first attracted attention and the first detectable signs of damage have needed the more delicate modern methods. It must be admitted, of course, that delicacy is, like many terms, relative; but an attempt is certainly being made to investigate the finer changes in the coronary vascular system and the equally vital junctional tissue of the heart affected by the rheumatic state. These last cautious words are deliberately chosen, for there is more than a suggestion that anaphylactic changes are concerned in acute rheumatic disease. It is interesting to reflect that the curious necrotizing processes characteristic of rheumatic heart disease were described in the same pathological era as the foundation work on anaphylaxis. Coronary angiitis in rheumatic heart disease has interested pathologists and clinicians for some time, and it would seem reasonable to look here for a probable explanation of the infrequent but distressing occurrence of sudden death in these cases.

George C. Griffith and Robert W. Huntington have described three cases in which rapid death occurred in young men in the United States Navy.[1] It is surprising that these writers draw their material from a total of 7,165 cases of rheumatic fever in a naval base hospital; of 13 fatal cases there were three in which death was sudden. The case histories are unusual. One was that of a man who had been suffering from subacute rheumatism and who was thought a good subject for tonsillectomy in view of the apparent quiescent state of the condition. The operation was performed without trouble under local anæsthesia, but an hour afterwards he suddenly collapsed and died. At autopsy rheumatic arteritis was found, causing coronary insufficiency. The second patient presented no signs of cardiac affection on enlistment, but later was found to have evidence of aortic disease, which was proved by investigation and the emergence of other signs of activity to be of rheumatic origin. When apparently well he fell from a canoe, after emitting a cry, and was found later to have died from an undetermined combination of submersion and acute occlusion of a branch of the left coronary artery following acute rheumatic arteritis. The third patient was under treatment for acute rheumatism and after a rapidly increasing degree of precordial pain died abruptly. In this instance also acute vascular lesions were found at autopsy, but these were remarkably widespread and there were numerous areas of infarction. The most striking feature common to all cases was the occurrence of distinctive lesions at the base of the aorta. The authors feel sure that much of the change seen in the coronary arteries was recent, in view of the clinical records and electrocardiographic studies carried out on these patients before the terminal event. They point out that while certain tissue accumulations must have been laid down prior to the dramatic changes in the patient's clinical state, some of the alterations in the cardiac tissues might well be considered as evidence of an extremely early type of vascular damage. These were of the nature of a hyaline or collagenous degeneration, and it is possible that some anaphylactic mechanism might be invoked to explain them. Griffith and Huntington argue that the valvular and myocardial changes were without doubt of rheumatic origin, and therefore they believe that they are justified in attributing the preterminal changes to the same ætiological cause. It is of interest that the third patient of their series was originally thought to be suffering from an "atypical" pneumonia, but the diagnosis was later changed to one of acute rheumatism, with rheumatic pneumonic lesions superadded to the cardiac involvement.

It cannot be said that the riddle of why these patients died so suddenly is solved, but the morbid anatomist is seldom able to answer this question satisfactorily. It is not difficult to postulate a rapid nutritional deficiency of the vital Purkinje cells, following a failure of blood supply which comes too quickly for any compensation to occur, but such considerations may not allow us to anticipate a possibly fatal emergency. In cases of gross nutritional imbalance and deficiency sudden death may also occur, as reports from prison camps have shown, and it is possible that, although the underlying ætiology is different, the production of cardiac arrest may be similarly explained. Indeed the sudden death from apparently convulsive cerebral causes which has been observed in association

[1] *Annals of Internal Medicine*, August, 1946.

with certain infections, but whose nature even autopsy may leave unexplained, is a comparable conundrum. We can only conclude that there are rapid pathological processes whose exact nature we may never be able to fathom except by deduction. However, there is always the hope that foreknowledge may not always be impossible, and in the meantime morbid anatomists and physiologists are trying to discover the earliest manifestations of the rebellion of cells to an incompatible environment.

GONORRHŒAL PERIHEPATITIS.

THOUGH peritoneal inflammation in the lower part of the abdomen due to gonococcal infection is well known as a possible cause of acute abdominal disease in young women, not so many cases of peritonitis affecting the upper part of the abdomen are on record. Nevertheless there is a considerable volume of literature accumulating on this subject, which was first described as a definite syndrome by Stajano in 1919. This and other contributions to the literature are used as the background of an article on this complication of gonorrhœa in the female by Malcolm M. Stanley.[1] This author reports the successful treatment of three patients with penicillin. He remarks that perhaps this condition has been rather neglected because the original publication and others immediately following it were published in Spanish and French and not widely circulated. Some years later other writers added to the general information on this topic, describing the frequent association of gonorrhœal salpingitis and slender adhesions between the liver and the abdominal wall, and also establishing an exact bacteriological diagnosis in the course of laparotomy. All the described cases have occurred in women, for anatomical reasons, though the exact path of the infection within the abdominal cavity is in doubt. The clinical picture is fairly distinctive. The onset is very dramatic as a rule, with severe pain in the upper part of the abdomen, usually on the right side, under the margin of the ribs. The pain is often felt acutely under the top of the right shoulder, and is exaggerated by any deep or quick respiration, and by movements of the trunk. It is often referred down the right arm, though the right side has by no means the monopoly of site of pain, as this may be on the left side, or on both, or may alternate. Hiccup, as might be expected, is common. Nausea occurs in many patients, and occasionally vomiting. This pain, characteristically in the upper part of the abdomen, dominates the clinical picture, even though a certain degree of pain in the lower abdominal quadrants may also be present. Fever, accompanied by sweats and chills, may also be observed. One interesting point in the history is that the acute symptoms have frequently been preceded by some form of trauma affecting the pelvic organs. Physical examination shows muscular spasm and tenderness, and a friction rub may sometimes be heard at the anterior costal margin. This may be confusing, especially if, as sometimes happens, there are signs of some effusion into the pleural cavities. The diagnosis that may most easily be made in error is cholecystitis. Stanley has no faith in cervical smears as a method for obtaining confirmation of the ætiology of the condition, but states that incubation of the cervical or urethral secretions in a culture medium will always reveal gonococci. As already pointed out, the causal organisms have been demonstrated in the peritoneal exudate in these cases.

There is ample evidence that the process is a serofibrinous peritonitis, with little or no tendency to become purulent. Though the natural course of this complication is towards resolution and no fatalities have been recorded, the attainment of complete cure is slow and may be retarded by relapses. It might be expected that penicillin would be the ideal method of treatment, and Stanley's series confirms this. The diagnosis was assured by the typical clinical picture and by bacteriological and serological tests. Penicillin was given in doses of 15,000 units by intramuscular injections every three hours, and in each case all symptoms had disappeared within twenty-four hours and each patient progressed rapidly to complete cure. Stanley believes that this syndrome occurs more frequently than is generally believed and that the correct diagnosis is therefore missed in a certain number of cases. It is important that the possibility of this condition should be remembered; those affected will of course not infrequently include women who have no apparent or at least no obvious gonococcal infection. Surgical intervention is not only unnecessary, but also undesirable, and now that penicillin is freely available only an accurate diagnosis and a few days' treatment are required to cure a condition that may appear at the outset most alarming.

[1] *Archives of Internal Medicine*, July, 1946.

MICROFLORA OF THE ALIMENTARY CANAL.

THE name of Sir Joseph Barcroft is indissolubly linked with research on hæmoglobin and evokes thoughts of a long and successful life work in the field of respiration. It will come as something of a surprise, therefore, to find him giving an address to the Royal Society of Edinburgh on the microflora of the alimentary canal.[1] His facts and comments concern the herbivorous animal and at first sight may seem to have little immediate interest in human physiology, but there are facts disclosed which must be considered in human digestion and metabolism. Herbivorous beasts have either a capacious rumen or, as is the case with the horse, a capacious colon, where bacteria can multiply in moist heat and effect profound changes in the ingested fodder. That urea administered to a cow can be metabolized into protein has been proved beyond the possibility of challenge, and this synthesis is carried out by unicellular organisms in the rumen.[2] Barcroft's main attention has been directed to the changes which carbohydrates undergo when subjected to bacterial attack. That polysaccharides must be broken down into monosaccharides for absorption to take place is an established doctrine in physiology, but Barcroft points out that a considerable part of the carbohydrates in fodder is carried further and appears as volatile acids, particularly acetic, butyric and propionic acids. What is the fate of each of these? Acetic acid or an acetate introduced into the stomach disappears, but cannot be found in the urine; the same happens with butyric acid, but the stages of transformation and ultimate destiny are unknown. The case is different with propionic acid, for a phloridzinized animal turns some 88% of the ingested propionic acid into glucose, thus proving the possibility of this synthesis.[3] Since Barcroft gave this address it has been discovered that in the phloridzinized sheep some 25% to 30% of acetate injected into the peritoneal cavity is transformed into glucose.[4] Barcroft draws attention to the fact that cellulose can be hydrolysed by a coccus in the herbivorous alimentary canal into iodine-staining bodies, presumably of the nature of starch, glycogen or dextrin. One practical application of this in human affairs is the addition of fresh cow manure to septic tanks in order to effect the disintegration of toilet paper. Barcroft also shows that a bacterium can turn simple carbohydrates into acetic, butyric and propionic acids, but exactly what functions these play, whether advantageous or not, is left for future research to disclose. The main problem of bacterial action as it concerns the human alimentary canal is the synthesis of vitamins, particularly the water-soluble *B* and *C*; but this Barcroft deals with rather superficially as outside his thesis. One small matter affecting human physiology is this: the characteristic odour of vomitus is derived from butyric acid, even though no fat containing the acid as ester is present in the food. Is it possible that bacterial disintegration of carbohydrate is responsible?

[1] *Proceedings of the Royal Society of Edinburgh*, Section B, Volume LXII, 1945-1946, page 105.
[2] E. C. Owen, J. A. B. Smith and N. C. Wright: *Biochemical Journal*, Volume XXXVII, 1943, page 44.
[3] Phillipson and Marshall: Cited by Sir Joseph Barcroft, but without reference.
[4] I. G. Jarrett: THE MEDICAL JOURNAL OF AUSTRALIA, October 19, 1946, page 571.

XUM

Abstracts from Medical Literature.

PATHOLOGY.

Adenocarcinoma, Cylindroma Type, of the Parotid Gland.

FRANK W. QUATTLEBAUM, MALCOLM B. DOCKERTY AND CHARLES W. MAYO (*Surgery, Gynecology and Obstetrics*, March, 1946) state that 10% of a series of consecutive primary parotid neoplasms appeared to be adenocarcinomata of the type cylindroma, so classified because of a distinctive microscopic pattern. This group of 21 cases was characterized clinically by the presence of sharp radiating pain the local fixation of the tumour in 40%, features unusual in connexion with other primary neoplasms of this location. Partial or complete paralysis of the facial nerve was also a contrastingly common finding. Surgically, the tumours were generally more infiltrative than encapsulated and application of the principle of "wide local excision" prevented recurrences in 5 of 21 cases. Pathologically, the appearance of dark-staining epithelial islands and strands with central honeycombing in a hyaline stroma was diagnostic. Epithelial mucus was sometimes present. Infiltrative tendencies were pronounced, with a special predilection for invasion of nerve sheaths. Eight of the twenty traced patients succumbed within five years to the effects of metastasis, five with evidence of pulmonary spread. Two died more than five years after operation. Four of the remaining ten are suffering from inoperable recurrences. Solid tumours of the parotid gland, the authors state, should be assumed to be malignant until proved otherwise. They suggest that more radical surgical procedures will have to be undertaken in order to obtain better results in the treatment of this form of neoplasm.

Chemical Factors and their Role in Inflammation.

ACCORDING to Valy Menkin (*Archives of Pathology*, April, 1946) the development of the inflammatory reactions follows a fundamental pattern. This in turn is conditioned by some common denominators that can be extracted from the exudative material. For instance, the increase of capillary permeability and the migration of polymorphonuclear leucocytes are primarily referable to leucotaxine, presumably from injured cells. Glucose is likewise produced by damaged cells. The leucocytosis frequently accompanying inflammatory processes is apparently due to a protein in the pseudoglobulin fraction of exudate. This substance, besides inducing a discharge of immature granulocytes from the bone marrow, also causes a marked hyperplastic reaction of these elements and of megakaryocytes in the marrow. The leucocytosis-promoting factor (LPF) affects the circulating leucocytes of dogs and of guinea-pigs. The canine leucocytosis-promoting factor is both innocuous and active in human beings. When injected into the blood of man it induces a rise in circulating leucocytes ranging from 80% to 150%. The pattern of injury causing inflammation seems primarily referable to a toxic euglobulin liberated by injured cells. This factor has been termed necrosin. When intravascularly injected it induces injury of the liver and frequently of the kidney. The injury of the liver varies from a denudation of the cytoplasm of the hepatic cell and replacement with abundant glycogen to a large deposition of fat. The fever that occurs with inflammation seems referable to what is possibly a glycopeptide, termed pyrexin. Pyrexin appears to act on the heat-regulating centres of the central nervous system. Although purified necrosin is non-pyrogenic, incubation of this substance frequently yields a pyrogenic substance, suggesting the pyrexin is possibly the product of enzymatic activity associated with necrosin. The leucopenia often observed with inflammation seems referable, at least in numerous instances, to a leucopenic factor which can be recovered from exudative material, particularly if the latter is at an acid pH. The leucopenic factor is often in close association with pyrexin, and it appears to be a heat-stable polypeptide. Its action appears to be a trapping of leucocytes in the alveolar walls of the lung, in the sinusoids of the liver and in the spleen. The cells retained in the spleen may perhaps be of aid in the further understanding of the acute splenic tumour accompanying numerous inflammatory processes.

Gynæcomastia.

ACCORDING to Howard T. Karsner (*The American Journal of Pathology*, March, 1946) gynæcomastia is much more frequently unilateral than bilateral, and the unilateral lesions are about equally divided between the two sides. It may occur at almost any time of life, but is especially frequent in the third decade. Only rarely does it succeed directly upon the pubescent subareolar node. After reaching a certain size, which varies widely from case to case, the tissue ceases to grow, but reduction in size is rare. Resolution, to the point of complete cicatrization, occurs in breasts with active proliferation, but is limited to small foci and does not indicate resolution of the whole lesion. There is no clear indication that true neoplasia supervenes. When gynæcomastia accompanies manifest endocrine disorders it is usually bilateral, but not always equal, and occasionally only one breast is enlarged. In such cases, epithelial proliferation is conspicuous, but it is no greater than that frequently seen in unilateral gynæcomastia without demonstrated endocrine disturbance. From present knowledge of assays of hormones, no generalizations can be made. In obvious endocrine disorders, hormonal imbalance is observed, but increase in œstrogenic substances is frequent. Experimental results and observations on man, when correlated, point toward œstrin as the important factor. Even though androgens may excite proliferation in the mammary gland of laboratory animals, there is little if any evidence that they, of themselves, have the same effect in man. Unilateral enlargement may possibly be due to hormonal imbalance or hyperœstrinism acting over a long time on receptors especially sensitive on the one side, but of such small proportions as not to be demonstrable by current methods of assay. Trauma or irritation may draw attention to the lesion and may perhaps augment growth, but there is no satisfactory evidence that either one is causative, nor is there evidence that hereditary or constitutional factors (other than those implied in certain endocrine disorders) play any significant part. When treatment is required, it should be surgical. Results have not justified the use of endocrine products in treatment of gynæcomastia.

Teratoma of the Anterior Mediastinum in the Group of Military Age.

A STUDY of the clinical course and morphological characteristics of teratoma was made by Hans G. Schlumberger (*Archives of Pathology*, April, 1946). He deals with sixteen cases in which the growth occupied the anterior mediastinum. In ten of these cases the growth was benign and in six cancerous. All the patients fell within the military age group of eighteen to thirty-eight years; fifteen were males, one was a female. In the specimens of benign teratoma the most frequently encountered organoid structures were "skin", "intestine", "bronchus" and "pancreas". The incidence of well-developed pancreas in six of the ten specimens is remarkable in view of its infrequent occurrence in specimens of teratoma of other regions. The specimens of cancerous teratoma of this series were characterized by almost complete absence of ectodermal derivatives, such as skin or nerve tissue. The connective tissue was loose and cellular and may have undergone cancerous change. The cancerous epithelium was arranged as adenocarcinoma in each instance. Well-differentiated organoid epithelial structures were absent Metastases were found in four cases. During the past half-century the experimental analysis of morphogenesis has made important advances. Outstanding among these has been the development of the concept of the organizer which holds that substances ("organizers") liberated by one group of cells may determine the differentiation and the organization of other groups of cells. The hypotheses of the genesis of teratoma have been examined in the light of advances in embryology. It is concluded that teratoma of the ovaries and the testes is due to abnormal growth and differentiation of undifferentiated precursors of the germ cells. Extragonadal teratoma, however, is the result of a local dislocation of tissues during embryogenesis. Teratoma of the anterior mediastinum probably arises from tissue dislocations in the *Anlage* of the thymus.

Studies on Chancroid.

WALTER H. SHELDON AND ALBERT HEYMAN (*The American Journal of Pathology*, March, 1946) have studied the histological character of chancroidal infection in specimens taken for biopsy from 45 patients. They formed part of a series of 125 cases selected for a special study of chancroid and *lymphogranuloma venereum*. In 35 of these 45 cases, the histological diagnosis of chancroidal infection was confirmed by culture of the Ducrey bacillus obtained from the same lesions. The organism was not grown from the other ten cases, in which, however, the clinical picture was consistent with the diagnosis of chancroid. The histological picture of chancroid is sufficiently

distinct to permit diagnosis and to differentiate this condition from other genital lesions. Useful features are the zonal character of the inflammatory reaction, the marked endothelial proliferation in the mid-zone, the meagre fibroblastic response at the same level, and the dense infiltration with plasma cells and lymphocytes in the deepest zone. The advantages of biopsy in the diagnosis of chancroidal infection are such that this procedure is suggested as a practical diagnostic tool.

The Syndrome of Leuchanæmia.

A CASE of leuchanæmia is described by J. F. Murray (*The Journal of Pathology and Bacteriology*, April, 1946) with complete hæmatological, clinical and post-mortem findings. It commenced as a typical macrocytic anæmia, with Ehrlich's megaloblasts and giant stab cells in the sternal marrow, the latter being regarded as just as characteristic of the macrocytic anæmias as are the former. Free acid was present in the gastric juice after histamine had been given. In the later stages of the disease the blood became leuchæmic, with 30,000 to 189,000 white cells per cubic millimetre, 80% to 90% of which were myeloblasts; some paramyeloblasts were present which are regarded by the author as pathognomonic of the myeloblastic leuchæmias. It is suggested that the red and white cell changes which occur in leuchanæmia are due to a maturation defect in the stem cell (hæmocytoblast), which affects both the erythroid and myeloid series, and that the defect may be due to the absence of some unknown factor or factors necessary for the proper maturation of the hæmocytoblast and the orderly formation and development of both red and white cells.

MORPHOLOGY.

Sympathetic Rami in Man.

J. PICK AND D. SHEEHAN (*Journal of Anatomy*, January, 1946) have investigated the connexions of the human sympathetic chain in 25 cadavera and describe the commonest types of ganglia found in each segmental level. There was great complexity in the lumbar region and it was rarely possible to define an independent "third" or "fourth" lumbar ganglion. The different types of ganglia found respectively in the cervical, thoracic, lumbar and sacral regions reveal a fundamental pattern, indicative of a splitting and secondary fusion of each primordial ganglionic mass. Ganglia placed along the course of a ramus were surprisingly common, especially in the lower lumbar region, and resulted from a greater degree of peripheral migration of cells than usually obtains. A double sympathetic chain occurred anywhere along the sympathetic chain, but never extended for more than the distance between two adjacent ganglia, and probably therefore does not present any surgical problem. Transverse connexions between the sympathetic chains of each side were never found above the level of the fifth lumbar vertebra. The possibility of any bilateral innervation of the limbs via such transverse connexions can be almost certainly excluded. Examples of rami connected with every spinal nerve have been studied histologically. The same four types of rami, according to fibre constitution, as described previously in the monkey, are present in man. In the thoracic region, it was the rule for the white (or mixed) ramus to be that which joins the spinal nerve most distally; in the lower thoracic and upper lumbar regions the "transverse" rami were almost invariably grey, and the "oblique" white. The number of fine myelinated fibres (under 3μ in diameter) within grey rami has been greatly under-estimated. They occurred in great numbers in the rami of the seventh and eighth cervical segments and again in those of the fifth lumbar and first sacral, a distribution corresponding to that found in the cat and monkey. The thoraco-lumbar outflow in man has been confirmed as first thoracic to second lumbar segments (inclusive).

Histochemical Reactions of Endometrium.

G. B. WISLOCKI AND E. W. DEMPSEY (*The American Journal of Anatomy*, November, 1945) have applied histochemical procedures to the study of the endometrium of a variety of pregnant and non-pregnant animals, including man, to investigate the presence of iron, calcium, glycogen, lipoids and acid and basic phosphatases. In addition, basophilia, which probably indicates the presence of cytoplasmic nucleo-proteins, and the Bodian protargol reaction, which in some circumstances appears to be indicative of formed deposits of calcium, were studied. Iron was present in the uterine glands during pregnancy in most species, but not in those of non-pregnant animals. Similarly the Bodian protargol reaction was obtained only during pregnancy, whereas glycogen and lipoids appear in the uterine wall before implantation. It is pointed out that these differences seem understandable, glycogen and lipoid material presumably representing readily available and necessary sources of energy for the developing blastocyst from the outset, whereas iron and calcium fulfil their roles principally in the relatively late onset of erythropoiesis and calcification of bone. These findings are discussed in relation to the physiological activity of the endometrial tissues during pregnancy.

Intraneural Topography of the Radial, Median and Ulnar Nerves.

S. SUNDERLAND (*Brain*, December, 1945) has investigated the intraneural topography of the radial, median and ulnar nerves. There was no constant or characteristic funicular pattern for any nerve. Variations occurred at different levels along the same nerve, at the same level on the two sides of the body, and from nerve to nerve and subject to subject at any given level. The funicular pattern was continually modified along the entire length of each nerve by the repeated division, anastomosis and migration of the bundles. Each of these features has been described. The longest section of any nerve with a constant pattern was fifteen millimetres, though individual bundles and bundle groups pursued longer courses. The average length over which the pattern remained constant varied between 0·25 and 5·0 millimetres. The author describes three fundamental types of funicular intercommunications and the nature and extent of the redistribution of the fibres which was brought about by those intercommunications. The significance of the intraneural topography has been discussed in relation to the nature, extent and peripheral effects of injury to a nerve; the rate and order of regeneration following injury; the mobilization, resection and suture of nerves; the regeneration and prognosis following nerve suture; and the selective loss of function following nerve compression.

Medullary Striæ of the Fourth Ventricle.

A. T. RASMUSSEN AND W. T. PEYTON (*Journal of Comparative Neurology*, June, 1946) present evidence that the *striæ medullares* of the fourth ventricle, long believed to consist of fibres of secondary auditory neurones, are continuous along the median raphe with the ventral external arcuate fibres, and they suggest that they represent aberrant transverse fibres of the pons and that the arcuate nuclei are caudally placed pontine nuclei. They also submit evidence, based on degeneration experiments, that the nuclei of the dorsal columns, namely, *nucleus gracilis* and *nuculeus cuneatus*, do not contribute fibres to the ventral external arcuate system.

Lymphatics of Synovial Membranes.

D. D. DAVIES (*Journal of Anatomy*, January, 1946) has studied the lymphatic vessels of certain joints using 50% mandarin black ink and the stab technique. The synovial lymphatic plexus with its extraarticular connexions is described. No evidence was found of drainage of the synovial lymphatics directly into the neighbouring veins. All injections were confirmed histologically.

Interrelation of the Globus Pallidus and Thalamus

P. GLEES (*Brain*, December, 1945) shows that the interconnexions of the *globus pallidus* (pallidum), thalamus and hypothalamus are far more extensive than was formerly thought. Experimental lesions of the *globus pallidus* were made in nine monkeys and the resulting degeneration was studied with the Marchi technique. Area 4 of the cortex (motor area) was found to project into the putamen, area 6 (premotor) into the pallidum. The caudate nucleus and putamen send their fibres mainly into the pallidum. The internal division of the rostral part of the pallidum forms the *ansa lenticularis* which sends fibres into the ventral anterior nucleus and the ventro-medial nucleus of the hypothalamus. Some fibres of the internal division pass directly into the ventral anterior nucleus. External and internal divisions together form the *fasciculus lenticularis* and pallido-subthalamic fibres. The *fasciculus lenticularis* distributes numerous pallidal efferents into the lateral thalamic nucleus via Forel's field and the *fasciculus thalamicus*. Some fibres from Forel's field terminate in the mammillary body and hypothalamus, while others end in the region between mammillary body and subthalamic nucleus as far as the level of the interpeduncular nucleus. The fibre tracts described above indicate a close interrelationship between the striopallidum, the thalamus and hypothalamus.

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Bibliography of Scientific and Industrial Reports.[1]

THE RESULTS OF WAR-TIME RESEARCH.

During the war a great deal of research was carried out under the auspices of the Allied Governments. It has been decided to release for general use a large proportion of the results of this research, together with information taken with former enemy countries as a form of reparations. With this end in view, the United States Department of Commerce, through its Publication Board, is making a weekly issue of abstracts of reports in the form of a "Bibliography of Scientific and Industrial Reports". This bibliography is now being received in Australia, and relevant extracts are reproduced hereunder.

Copies of the original reports may be obtained in two ways: (a) Microfilm or photostat copies may be purchased from the United States through the Council for Scientific and Industrial Research Information Service. Those desiring to avail themselves of this service should send the Australian equivalent of the net quoted United States price to the Council for Scientific and Industrial Research Information Service, 425, St. Kilda Road, Melbourne, S.C.2, and quote the PB number, author's name, and the subject of the abstract. All other charges will be borne by the Council for Scientific and Industrial Research. (b) Those marked with an asterisk may be obtained by approved applicants without cost on making application to the Secondary Industries Division of the Ministry of Post-War Reconstruction, Wentworth House, 203, Collins Street, Melbourne, C.1. Copies of these are available for reference in public libraries.

Further information on subjects covered in the reports and kindred subjects may be obtained by approaching the Council for Scientific and Industrial Research Information Service, the Secondary Industries Division of the Ministry of Post-War Reconstruction, or the Munitions Supply Laboratories (Technical Information Section), Maribyrnong, Victoria.

SMITH, HOMER W., CRAWFORD, BETTY, AND HOUCK, C. RILEY. Studies on the cause of death after systemic intoxication with the β-chloroethyl vesicants, to March 1, 1944. (OSRD Report 3467.) Off. Pub. Bd., Report, PB 5929. 1944. 97 pp. Price: Microfilm, $1.00; Photostat, $7.00.

The experimental studies included here are concerned primarily with the physiological disturbances issuing from systemic intoxication caused by the nitrogen mustards. Notable in this intoxication is injury of the intestinal mucosa and the blood-forming organs. A review of the literature on intestinal injury and other observations bearing on the cytotoxic action of the β chloroethyl vesicants is given. Other reviews dealing with the biochemistry and pathology of the vesicants are included in the bibliography. It appears that the systemic effects of H and the nitrogen mustards are very similar, and the conclusions drawn from the present studies are considered to bear directly upon H intoxication. Tables and graphs are included. This is a progress report under contract with New York University.

MORITZ, A. R., AND HENRIQUES, F. C., JUNIOR. Additional studies pertaining to the mechanism of cutaneous injury by mustard gas. An experimental study using mustard prepared with radioactive sulphur, to October 1, 1945. (OSRD Report 3620-A.) Off. Pub. Bd., Report, PB 5917. 1945. 46 pp. Price: Microfilm, 50c.; Photostat, $4.00.

Pages and sections of this report have been numbered to correspond to the pages and section of OSRD Report 3620 (PB 5930), to which these data, obtained between November, 1943, and December, 1944, are supplemental. This constitutes a complete and final report giving all the reliable data pertaining to the mustard investigations that were obtained under Contract NDCro-169 with Harvard University. For PB 5930 see page 429.

MORITZ, A. R., AND HENRIQUES, F. C., JUNIOR. An experimental investigation of the physiological mechanisms concerned in the production of casualties by flame thrower attack, to October 1, 1945. (OSRD Report 6182.) Off. Pub. Bd., Report, PB 5942. 1945. 27 pp. Price: Microfilm, 50c.; Photostat, $2.00.

This report discusses experiments elucidating the mechanism of death from cutaneous exposure to heat. It was concluded that the electrocardiographic changes in animals exposed to high temperatures were the result of hyperpotassæmia. The cause of the hyperpotassæmia is traced mainly to liberation of potassium from the red blood cells. Tables and charts are included. This is a final report under contract with Harvard University. The experimental work was done by A. Roos, J. R. Weisiger, A. R. Moritz and R. McLean.

NOLLER, CARL R. Report on "The sternutatory properties of certain organic compounds", to September 20, 1942. (OSRD Report 941.) Off. Pub. Bd., Report, PB 5556. 1942. 44 pp. Price: Microfilm, 50c.; Photostat, $3.00.

A survey of the literature concerning organic compounds having sternutatory properties, and which do not contain arsenic, antimony and other metals and are not related to the amides, capsicin or piperine is given. Over 120 compounds have been obtained, largely by synthesis, and tested and compared qualitatively for sternutatory action. The benzalmalononitriles were the most active and readily prepared, and most extensively investigated. Tables and a bibliography of eighty-nine references are given. This is a progress report under contract with Stanford University. The experimental work was performed by H. G. Sturz and E. W. Torbohn.

RANDALL, FRANCIS E., AND DAMON, ALBERT. Anthropometric facial survey at Wilberforce University. (Army Air Forces. Experimental Engineering Section. EXP-M-49-695-4.) Off. Pub. Bd., Report, PB 6936. 1942. 7 pp. Price: Microfilm, 50c.; Photostat, $1.00.

This report gives results of an analysis of anthropometric facial data taken on 132 ROTC Negro students at Wilberforce University, Xenia, Ohio, and their relation to the oxygen mask. Tables and figures.

RENSHAW, BIRDSEY. Observations on the role of water in the susceptibility of human skin to vesicant vapours, to April 12, 1945. (OSRD Report 5169.) Off. Pub. Bd., Report, PB 5876. 1945. 36 pp. Price: Microfilm, 50c.; Photostat, $3.00.

Observations are presented on the relative severity of the injuries produced by the vapours of H[1] and HN1 on (*a*) cool, not visibly sweating skin, and (*b*) comparable skin wetted with water and in some instances covered by a thin, continuous layer of water. A single set of observations on the relative effects of sodium chloride solution and of water has also been made. It is concluded that the mere presence of large amounts of water on and in the surface layers is responsible for heightened susceptibility of hot, sweating skin to the vapours of H and HN1. Tables, diagram, photograph, and a sample of the lens paper used in the experiments are included. Details of experiments are given in appendices.

ALEXANDER, S. F., AND GINSBURG, T. H. Intravenous oxygen therapy of phosgene poisoning; effects of intravenous oxygen administration. (Chemical Warfare Service. Medical Division. MD(EA). Memorandum Report 52.) Off. Pub. Bd., Report, PB 11184. 1942. 12 pp. Price: Microfilm, 50c.; Photostat, $1.00.

Goats gassed with phosgene and treated with intravenous oxygen infusions rapidly died. Their mortality was universal and their survival time only a fraction of that of control goats. Studies of the action of intravenous oxygen alone in the goat and rabbit disclosed that the lethal factor was obstruction of the pulmonary arterial vascular bed followed by lung œdema and right heart failure. This action complementing phosgene poisoning is rapidly fatal. Tables, a graph, and a bibliography are included.

DZIEMIAN, ARTHUR J. The effects of body-gassing with H vapour on the carbohydrate metabolism of dogs. (Chemical Warfare Service. Medical Division Report 59.) Off. Pub. Bd., Report, PB 9530. 1945. 28 pp. Price: Microfilm, 50c.; Photostat, $2.00.

Experiments indicate that body-gassing of dogs with H vapour causes a moderate hyperglycæmia during the first two days after gassing, followed by a decrease to normal or hypoglycæmic values by the fifth or sixth day after H. After H the oral glucose tolerance curves become flatter than normal, but are delayed in returning to the initial blood glucose values, giving a plateau type of curve as shown. This flattening may be partially due to the increased disappearance of added glucose from the blood (shown by the intravenous glucose tolerance tests), and also to a possible decrease in absorption of glucose through the intestinal wall. Insulin tolerance tests indicate a somewhat increased sensitivity to insulin over normal in the H treated dog. Appendices contain tables and diagrams presenting test data and results. Bibliography is included.

HAMILTON, JOSEPH G., AND AXELROD, DOROTHY. Determination of the distribution of H and L in skin and eye tissues by radioautographic techniques, progress report. (OSRD Report 1911.) Off. Pub. Bd., Report, PB 6521. 1943. 32 pp. Price: Microfilm, 50c.; Photostat, $3.00.

The distribution of two vesicants, mustard and Lewisite (labelled with radioactive sulphur and arsenic, respectively), in skin and eye tissues has been studied using the radio-

[1] Supplied by the Information Service of the Council for Scientific and Industrial Research.

[1] H = β′β″ dichlordiethyl sulphide; HN1 = ethyl di-(2-chloroethyl) amine.

autographic technique. In human skin the radioactively tagged mustard was fixed in the epidermis and to a less extent in the corium. Radioactively tagged Lewisite was fixed primarily in epithelium with very little in the corium, in tissues excised at twenty-four hours after exposure. Comparison of the stained histological sections with the films exposed to the action of the radioactive tracers serves to show the depth of penetration of the vesicant in the tissues and part of the histological distribution. A method for quantitizing the darkening of photographic film in radioautography is described. Photographs and a graph are included. This is a progress report under contract with the University of California.

KIDD, JOHN G., AND LANDSTEINER, KARL. Induced hypersensitivity to bis (β-chloroethyl) sulphide (mustard gas) and to 2, 3-dimercaptopropanol (BAL) in guinea-pigs. Formal progress report, January 2, 1944. (OSRD Report 3269.) Off. Pub. Bd., Report, PB 6520. 1944. 20 pp. Price: Microfilm, 50c.; Photostat, $2.00.

This report contains descriptions of experiments on the sensitization of the skin of guinea-pigs to mustard gas. Sensitization was regularly obtained and was enduring; all attempts at desensitization were fruitless. It also contains the first experiments demonstrating the sensitizing power of BAL in guinea-pigs. Tables and a bibliography are included. This is a progress report under contract with the Rockefeller Institute for Medical Research.

LAUGHLIN, ROBERT C. The therapeutic effect of BAL ointment in the eyes of rabbits contaminated with liquid mustard compared to irrigation with water and NDR 602 ointment. (Chemical Warfare Service, Edgewood Arsenal. Medical Division Report 12.) Off. Pub. Bd., Report, PB 9516. 1944. 21 pp. Price: Microfilm, 50c.; Photostat, $2.00.

Standard army issue BAL ointment has some beneficial therapeutic effect on liquid H contamination of the eyes of rabbits, although less than the effect of adequate irrigation, according to this report. Also BAL ointment is at least as effective as NDR 602 ointment on liquid H in the eye, and treatment by BAL ointment and irrigation combined is superior to irrigation alone. Tables are included in the report.

MAZUR, ABRAHAM, AND BODANSKY, OSCAR. The mechanism of the detoxification of PF3 and related fluorophosphafes in the animal organism. (Chemical Warfare Service, Edgewood Arsenal, Medical Division Report 29.) Off. Pub. Bd., Report, PB 9521. 1945. 28 pp. Price: Microfilm, 50c.; Photostat, $2.00.

Rabbit and human serum, red cells and tissues contain an enzyme which accelerates greatly the decomposition of fluorophosphates to the alkyl phosphoric acid, hydrogen and fluoride ions. This enzyme mechanism is important in the detoxification of PF3 and related fluorophosphates. Liver, which contains a high concentration of this enzyme, plays a significant role in the detoxification of these compounds in the intact animal.

PRATT, H. J., *et alii*. Intravenous toxicity of cyanogen chloride and sodium cyanide in dogs, goats and rabbits. (Chemical Warfare Service, Edgewood Arsenal, Medical Division Report 26.) Off. Pub. Bd., Report, PB 9518. 1945. 22 pp. Price: Microfilm, 50c.; Photostat, $2.00.

The object of the work covered by this report was to determine the intravenous toxicities and the rates of detoxication of cyanogen chloride and sodium cyanide in dogs, goats and rabbits. Tables present data on the results of the studies. This report concludes that anæsthesia has little effect on the susceptibility of rabbits to intravenously administered CK, the rate of detoxication of CK for dogs and rabbits and of NaCN for rabbits is constant in the range of dosages studied, and the rate for detoxication of CK for goats is a decreasing function of time within the range of dosages studied.

TATUM, HOWARD J., AND HIMMELFARB, SYLVIA. A comparison of the effect of breathing air and 100% oxygen under atmospheric and increased pressure upon the arterial oxygen saturation of CG gassed dogs. (Chemical Warfare Service. Medical Division Report 53.) Off. Pub. Bd., Report, PB 9528. 1945. 12 pp. Price: Microfilm, 50c.; Photostat, $1.00.

Dogs were gassed with CG at an average concentration of 0·3 mg./1 for ten minutes. A period of twelve to sixteen hours was permitted to elapse for the development of pulmonary œdema and hypoxia before institution of therapy. Results of experiments presented in tabular form indicate that continuous positive pressure breathing *per se* does not consistently elevate the arterial oxygen saturation in mildly CG poisoned dogs. Six to eight centimetres of water-positive pressure combined with 100% oxygen does not increase arterial oxygen saturation beyond that obtained with inhalations of oxygen at atmospheric pressure. A bibliography is included.

TATUM, HOWARD J., AND GINELER, ARTHUR M. Effects of increased intratracheal pressure in normal and CG poisoned dogs. (Chemical Warfare Service. Medical Division Report 30.) Off. Pub. Bd., Report, PB 9522. 1945. 11 pp. Price: Microfilm, 50c.; Photostat, $1.00.

A group of dogs was gassed with CG in concentrations ranging from 0·4 mg./1 for five minutes to 1·0 mg./1 for fifteen minutes. After an interval of six to eighteen hours to permit the development of pulmonary œdema, these animals, together with ungassed controls, were subjected to experiments to compare the effects of increased intratracheal pressure on the pulmonary tissue of dogs gassed with CG and of normal dogs. Results indicate that the response of venous pressure, arterial pressure and respiration in normal and in CG-gassed dogs subjected to similar levels of intratracheal pressure is essentially the same. The pathological changes in the pulmonary tissue resulting from increased intratracheal pressure consist of interstitial emphysema and air embolism.

ZINGARO, F. F., MCNAMARA, B. P., AND HARRISON, A. E. The comparative therapeutic value of various BAL products and certain derivatives in the treatment of rabbits' eyes exposed to Lewisite vapours. (Chemical Warfare Service. Medical Division. MD(EA) Memorandum Report 85.) Off. Pub. Bd., Report, PB 11383. 1943. 8 pp. Price: Microfilm, 50c.; Photostat, $1.00.

Experiments were conducted to determine the relative therapeutic value of several BAL products or derivatives in the treatment of rabbits' eyes contaminated by Lewisite vapours and the results are presented in graphic form. Eye solutions M-1, NDR-287, NDR-133-26, and NDR-133-27 show high effectiveness, but NDR-317 is of doubtful value.

HARTLEY, EUGENE L., AND JONES, DOROTHEA B. Final summary of research on the use of battle noise equipment. (Applied Psychology Panel, N.D.R.C. Project N-113. Report 12. OSRD Report 4931.) Off. Pub. Bd., Report, PB 12058. 1945. 21 pp. Price: Microfilm, 50c.; Photostat, $2.00.

This report summarizes the work on the applications of the battle noise equipment. Tables present data on percentage pick-up rate by experimental procedures, correlation of battle noise screening and ratings on forty gunners of twenty millimetre gun crews, and interest indicated in battle noise programme. The battle noise equipment is now located at the Marine Training Command, Camp Pendleton, and is being utilized there.

HARTLEY, EUGENE L. Progress report of study of adaptation to battle noise. (Applied Psychology Panel, N.D.R.C. Project N-113. Informal Memorandum 1.) Off. Pub. Bd., Report, PB 12053. 1944. 6 pp. Price: Microfilm, 50c.; Photostat, $1.00.

The present report summarizes the findings from preliminary analyses of the statements made by 24 men who were present each day of noise exposure and the over-all neuropsychiatric estimates of these men. The general findings reveal that about 60% of the men were unaffected by the battle noises, 20% were affected at first but showed adaptation through the course of the study, and the adaptation of the remaining 20% was definitely questionable. Attention is called to the importance of the findings, preliminary as they are, for the training of recruits and the classification and assignment of men.

HARTLEY, EUGENE L. Battle noise equipment, noise accompanied by moving pictures, study of use in selecting emotionally unstable men. Procedure applied to cases in the neuropsychiatric ward. (Applied Psychology Panel, N.D.R.C. Project N-113. Informal Memorandum 5.) Off. Pub. Bd., Report, PB 12057. 1944. 3 pp. Price: Microfilm, 50c.; Photostat, $1.00.

On two different occasions studies were made of the effect of battle noise accompanied by moving pictures on men in the neuropsychiatric ward. The results are presented in tabular form, with an analysis made only on the total score. Further work is now in progress attempting to evaluate the role of the noise alone, the moving pictures, and the test questions.

HELM, JOHN D., JUNIOR, AND GILMAN, ALFRED Z. Intravenous dose of nitrogen mustard (HN_3). (Chemical Warfare Service, Edgewood Arsenal. Medical Division Report 5.) Off. Pub. Bd., Report, PB 9509. 1944. 13 pp. Price: Microfilm, 50c.; Photostat, $1.00.

The object of the work reported herein was to observe the effects of a single intravenous dose of nitrogen mustard (HN_3) on man. It was found that the decrease in the lymphocyte count is a sensitive index of the systemic effect following injections of HN_3. The decrease in the platelet count and symptoms of headache and nausea are almost equally sensitive indices of the systemic effects of HN_3.

GOLDTHWAIT, RICHARD P. Conference on acclimatization. (Army Air Forces. Personal Equipment Laboratory, ENG-TSEAL-5H-3-134.) Off. Pub. Bd., Report, PB 11659. 1945. 5 pp. Price: Microfilm, 50c.; Photostat, $1.00.

The purpose of this report is to summarize a conference on acclimatization at the National Research Council and to suggest possible applications to Air Force personal equipment. A bibliography of papers offered and pertinent discussion is noted in Appendix I. It is concluded that there is no one criterion for heat load on an individual.

British Medical Association News.

SCIENTIFIC.

A MEETING of the New South Wales Branch of the British Medical Association was held on July 25, 1946, at the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, DR. A. C. THOMAS, the President, in the chair.

Bacterial Endocarditis.

DR. J. H. HALLIDAY read a paper entitled "Bacterial Endocarditis" (see page 731).

DR. JEAN ARMYTAGE read a paper entitled "Bacterial Endocarditis" (see page 736).

DR. V. J. MCGOVERN referred to a pathological specimen which he had placed on view. He said that in the specimen could be seen much scarring, but no acute lesion. Examination of a section from the valve revealed much fibrosis with thickening of the leaflet. In the vessels *endarteritis obliterans* was apparent, and at the base of the cusp there was a small focus of inflammation showing some healing. One surface of the leaflet also showed some fibrosis, and clot with red cells was attached to the superior surface. There was no inflammatory exudate relating to that clot, and no bacteria were found to be present at examination. The conclusion to be drawn was that no active infection was present.

PROFESSOR C. G. LAMBIE expressed his appreciation of the excellent review that he had given of the present state of knowledge of bacterial endocarditis. He said that not only were the members of the medical profession now in possession of a very potent weapon, but they also had advanced sufficiently to suggest a means of prophylaxis. Dr. Halliday had drawn attention to the necessity for cooperation with the members of the dental profession, and for the need for care concerning dental extractions in the case of subjects known to be susceptible. There were possibly other lines of prophylaxis besides injections of penicillin. It seemed that in many cases in which the gums were obviously in a diseased condition, cultural or other examination for organisms should be made, and if a heavy infection could be shown to be present, the dentist might be prevailed upon to stay his hand for a time until some treatment of the gums had been undertaken. This procedure would possibly not altogether prevent the entry of organisms into the blood, but would prevent massive infections, and massiveness of infection might have some relation to the formation of the disease process in the endocardium. The entry of streptococci of the viridans type into the blood after dental extraction might cause a febrile condition extending over months, even in the absence of bacterial endocarditis. The bacteria might produce allergic disturbances or possibly they might form secondary foci of infection in muscles, in fascia and in other organs. It might be that the bacteria regained entry into the blood from these secondary foci. These phenomena presented great difficulties in diagnosis. Professor Lambie then remarked that Dr. Halliday had omitted any reference to the use of heparin as an adjunct to treatment with the sulphonamides and penicillin; he asked whether Dr. Halliday thought this treatment had any sound basis.

DR. EVA SHIPTON said that she had enjoyed the papers. There were one or two points that required discussion. The first was the great difficulty experienced in recognizing early cases of bacterial endocarditis, and the importance that might be placed on the clinical pathologist's findings. Occasionally one encountered a patient with an elevated temperature, in whose blood or urine *Streptococcus viridans* was found; the patient might or might not have a cardiac murmur, and might or might not have undergone dental extraction. The blood sedimentation rate was sometimes extremely high; in other cases it was not much raised. Dr. Shipton asked how far one was justified in making the diagnosis of bacterial endocarditis on the finding of the organism in the blood and on an increase in the number of monocytes in the blood. As most of the patients whose blood yielded a growth of organisms had an increase in the number of neutrophile leucocytes with a shift to the left, that finding was not of much help in diagnosis. A useful test was cultural examination of carefully collected urine, when the blood failed to yield a culture of microorganisms. Dr. Shipton wondered what the readers of the papers thought of that finding in the presence of other clinical factors suggesting endocarditis. Dr. Shipton then discussed the case of the patient with early signs and symptoms, for whom early diagnosis was so necessary. She wondered whether such a patient should at once be treated with penicillin, on the assumption that the condition was bacterial endocarditis. The causal organisms were slow growers in culture media, and the clinician might have to wait for ten days or a fortnight for confirmation of the diagnosis. Once more Dr. Shipton asked whether the patient should be given treatment at once, or whether treatment should be delayed until the results of cultural examinations were known. Dr. Shipton finally referred to the large number of cases of bacterial endocarditis reported after World War I in England and other countries on the other side of the world. Many of the patients had no previous history of rheumatism; they were healthy young men with no previous cardiac lesions. Dr. Shipton wondered whether such cases were occurring after World War II. Some workers had held that the number of platelets in the blood was increased and that they were deposited on the heart valve, as a result of excessive exercise and fatigue.

DR. E. F. THOMSON remarked that it was fortunate that Christie had written his article so recently. He disagreed with Dr. Armytage's statement that it was unnecessary to determine the penicillin levels in the blood in most of these cases. Such an idea he held to be wrong. Dr. Thomson said that the penicillin level in the blood should be estimated in every case in which penicillin was being administered. Everyone responded differently to penicillin, and the level should be estimated in the first twenty-four hours of administration, so that some idea could be formed of how high the peak went, and how long it took to reach the peak; these points gave some guidance to dosage.

DR. M. JOSEPH referred to the theory that platelet thrombi formed a mesh in which bacteria became entangled, with the production of bacterial endocarditis; he said that the theory was interesting, and was adequate to explain many cases of rheumatic origin. But he wondered whether there was any evidence that this occurred in congenital cardiac lesions, such as patent *ductus arteriosus*, or patent intraventricular septum, or on the so-called MacCallum's patch, in those cases in which vegetations occurred there as isolated formations and not by extension from the mitral valve. Dr. Joseph joined with Professor Lambie in asking what was the therapeutic value of heparin in bacterial endocarditis.

Dr. Halliday, in reply to Professor Lambie and Dr. Joseph, said that when Loewe first published his successful series of six or seven patients treated with increased dosage of penicillin, he stated that he had used heparin in all, and he thought that the use of heparin had been a considerable factor in his success. Subsequent experience had taught clinicians that it was not the heparin, but the increased dosage of penicillin, that had been responsible for his success. English workers had used heparin only rarely. In one case in which the condition was refractory to all known methods of treatment and dosage, heparin was tried and failed. The theory on which heparin was used was that it increased the coagulation time of the blood, lessened the deposition of fibrin and platelets, modified the fibrin barrier and rendered the organisms more accessible to penicillin. Most American workers had now given up using heparin. It was very expensive and required daily estimation of the coagulation time of the blood, and unfortunately a number of fatalities had been recorded from cerebral hæmorrhage from undue prolongation of the coagulation time. In reply to Dr. Shipton, Dr. Halliday said that all those present had experienced her difficulties and worries. The criteria of diagnosis outlined must remain as their guide in difficult cases. A thorough search should be made for the occurrence of emboli. In Professor Christie's paper, to the use of which Dr. Thomson had made such friendly reference, it was laid down that embolic phenomena should be present in at least two systems. Dr. Halliday agreed with Dr. Shipton that when there was evidence of organic heart disease, the patient was febrile and the blood repeatedly yielded cultures of microorganisms, and when blood cells were present in the urine, one was safe in stating that the patient was suffering from bacterial endocarditis, and in not waiting for some major embolic incident before treatment was instituted. Of the value of culture of organisms from the urine as a diagnostic aid in the absence of cultures from the blood, Dr. Halliday was not in a position to speak. Referring to the cases which had occurred after World War I, to which Dr. Shipton had drawn attention, Dr. Halliday said that the explanation given was interesting. However, he thought that in view of the altered conditions of work and the possible introduction of the forty-hour week, they were not likely to encounter conditions arising from undue work and fatigue.

Dr. Armytage, in reply to Dr. Shipton, who had referred to the occurrence of monocytes in the blood of patients suffering from bacterial endocarditis, said that in the preparation of their papers she and Dr. Halliday had had to decide what to leave out for the sake of brevity, and they had agreed not to discuss hæmatology. However, the occurrence of monocytes was interesting; some pathologists would have seen patients whose hæmatological picture suggested leuchæmia or glandular fever. With regard to the cultural examination of the urine and the finding of *Streptococcus viridans*, Dr. Armytage said that she had not had much experience, but the point was possibly of value in diagnosis. The cause of hæmaturia in bacterial endocarditis was still open to debate. The lesions of the "flea-bitten" kidney had been described by Löhlein as embolic focal glomerulonephritis, but other observers had stated them to be focal proliferative lesions of toxic origin. It was possible to have a large infarcted area giving rise to gross hæmaturia, and the urine might then grow *Streptococcus viridans*. In some cases it was necessary to examine a number of specimens of urine before blood could be found microscopically, whereas in others blood in the urine was obvious to the naked eye. Referring to Dr. Thomson's remarks on the necessity for estimating the blood penicillin levels, Dr. Armytage said that Dr. Thomson worked in a large hospital that should undertake such estimations. However, it would be wrong to deter clinicians from treating these patients when they were not in a position to have the levels estimated. Only when they came across patients who were not responding to treatment should they transfer them to hospitals where the blood penicillin levels could be determined. Referring to platelet thrombi, Dr. Armytage said that they occurred in five out of ten bicuspid aortic valves. She did not know the incidence of these thrombi in other congenital lesions.

Dr. Thomas, from the chair, thanked Dr. Halliday and Dr. Armytage for their papers, and the speakers who had joined in the discussion. The papers had been highly skilled, interesting and informative. Dr. Thomas said that every general practitioner knew that when he struck cases such as those under discussion, he would have great difficulty in diagnosis, and very often he missed them; then it was only after many weeks, sometimes months, of study or after the patients had been transferred to larger hospitals, that the diagnosis was made. It was certain that those present at the meeting had learnt a lot about this horrible and fatal condition.

Medical Societies.

THE AUSTRALASIAN ASSOCIATION OF PSYCHIATRISTS.

A MEETING of psychiatrists was held at the Royal Australasian College of Surgeons on October 9, 1946. This meeting, which included delegates from Victoria, New South Wales, Queensland, Tasmania and South Australia, had been called for the purpose of forming an Australasian Association of Psychiatrists. This association was formed.

Election of Office-Bearers.

Professor W. S. Dawson was elected president and Dr. H. F. Maudsley, president-elect. Dr. A. J. M. Sinclair was elected honorary secretary.

The meeting then elected a General Council with representatives from each State and including New Zealand as follows:

Victoria: Dr. J. K. Adey, Dr. J. F. Williams, Dr. G. Springthorpe.
New South Wales: Dr. C. Swanton, Dr. D. Arnott, Dr. J. Ewen.
South Australia: Dr. H. Birch, Dr. H. M. Southwood.
Queensland: Professor J. Bostock, Dr. B. Stafford.
Western Australia: Dr. F. G. Prendergast.
Tasmania: Dr. N. Brothers.
New Zealand: Dr. D. G. McLachlan, Dr. G. Blake-Palmer, Dr. A. Gordon Couston.

Constitution.

Draft rules of association had been prepared and were discussed. In general terms the objects of the association are the furtherance of the principles of psychological medicine and mental hygiene. Membership is to be confined to medical practitioners engaged in the practice of psychiatry who possess either senior qualifications and experience in the practice of psychiatry, or who possess special attainments in the field of psychological medicine.

Provision is made in the draft rules for annual general and council meetings and for State meetings to be held at more frequent intervals.

Inaugural Address.

On October 9 Professor W. S. Dawson delivered his inaugural presidential address (see page 721). The Chancellor of the University of Melbourne, Mr. Justice Charles Lowe, and the Vice-Chancellor, Mr. J. D. G. Medley, were present together with representatives from the Royal Australasian College of Physicians, from the Royal Australasian College of Surgeons and from the teaching staffs of the various Melbourne hospitals.

Papers and Demonstrations.

On October 10 a clinical meeting was held at the Royal Melbourne Hospital at which Professor Bostock read a short paper on the relation of psychiatry to the general community (see page 730). Subsequently several clinical cases were presented and discussed. Members then visited the psychiatric clinic at the Children's Hospital.

The following day members visited the developmental centre at Travancore, where Dr. A. Phillips described the organization of the institution and conducted a tour of inspection, after which various case histories were examined and discussed.

Members then visited the Receiving House, Royal Park, where Dr. J. K. Adey and Dr. R. Webb presented several cases for discussion.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 204, of October 31, 1946.

CITIZEN NAVAL FORCES OF THE COMMONWEALTH.

Royal Australian Naval Reserve.

Promotions.—Surgeon Lieutenant Shane Andrew Clarke Watson, D.S.C., is promoted to the rank of Surgeon Lieutenant-Commander, dated 15th June, 1946. Surgeon Lieutenant Douglas Lockhart Barnes Fearon is promoted to the rank of Acting Surgeon Lieutenant-Commander, dated 30th September, 1946.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

The appointments of the following officers are terminated on demobilization with effect from the dates indicated: Flight Lieutenant Acting Squadron Leader N. Morrissy (254850), 18th September, 1946, (Flight Lieutenants) I. H. Ogilvy (257507), 17th September, 1946, J. L. Sinclair (257225), 24th September, 1946.

Obituary.

FRANK McCALLUM.

WE are indebted to Colonel A. Graham Butler for the following appreciation of the late Dr. Frank McCallum.

At the time of his tragic death on September 25, 1946, Dr. Frank McCallum, Director-General of Health for the Commonwealth of Australia, was fifty-six years of age, and was at the height of his powers. He had succeeded in that position on June 16, 1945, six months before the onset of his fatal illness, Dr. J. H. L. Cumpston, C.M.G., the first Director-General. McCallum's interests, activities and contacts were so varied that this obituary note takes the form of a symposium by some of his friends and colleagues.

McCallum's life falls naturally in three phases: his youth and preparation for his life work; his service with the first Australian Imperial Force, and with the Volunteer Defence Corps in the Second World War; and his professional life, almost entirely within the Commonwealth Public Service.

For details of his youth and war service the writer is indebted to Frank McCallum's brother, Mr. Colin McCallum

(Director of the Melbourne Public Library), to Dr. A. H. Baldwin and to Mr. John Balfour of the Official Historian's staff.

Frank McCallum was born at Ararat in Victoria on May 26, 1890. He was the eldest son of the Reverend Alexander McCallum, D.D., of the Wesleyan Church. Dr. McCallum's moves took the lad to various schools—the Friend's High School in Hobart, Warnambool College, and finally to Wesley College, Melbourne. At Wesley—Alma Mater also of his predecessor, Dr. Cumpston—he came under a renowned head, Dr. L. A. Adamson. Here, in the traditions of a great school, receiving and giving, a character, already favoured by nature and early nurture, matured and took form as strong, reliable, and withal of great attraction. Of his school life his friend Dr. Baldwin writes:

> At school Frank McCallum was not outstanding at sport, though he took part in football, cricket, rifle shooting and, in particular, rowing—at the university he rowed in Queen's College eight. Yet at school, where prominence in sport is almost a *sine qua non* of

> leadership, Frank was always prominent. It is interesting to try and trace the source of his popularity, for in it we find the basis of his later success. In part it was due to a happy charm of manner and speech, but far more to recognition of a character honest and natural. He abhorred shams and deceit in any person, no matter how highly placed. Far from being all things to all men, throughout his life he thought and acted with an essential honesty that won him friends in all walks of life. He retained this charm and ease of approach even when he had reached the highest position possible in his chosen sphere of action.

From Wesley he matriculated to the University of Melbourne, and in 1910 went into residence at Queen's College. His bent inclined him to an arts degree, but he chose medicine as a career. He did well, and had reached his fourth year. Then came the First World War. "With his character", writes Dr. Baldwin, "it was inevitable that he should enlist early, and so it was." Joining up as a private—Number 135—with Number 1 Australian General Hospital, he transferred in Egypt to the Sixth Field Ambulance, and served with that unit on Gallipoli till October, when he contracted typhoid fever, was invalided to Australia and was discharged in April, 1916. He reentered the medical school and completed his course, graduating M.B., B.S., in November, 1917. He promptly reenlisted as captain in the Australian Army Medical Corps, was posted in 1918 to the 11th Field Ambulance, and served as regimental medical officer with various battalions till the end of the war. After a brief "N.M.E." (as a house surgeon) he returned to Australia on transport duty and was demobilized in November, 1920. He began at once to study for the Public Health Service.

It is convenient here to follow through his further military associations. Throughout his life McCallum maintained close touch with the Diggers, with whom in the Australian Capital Territory Branch of the league he achieved the sort of standing that the returned soldier gives to men of his type. His speech at the social wind-up to a full meeting of State branches, held in Canberra in 1940, when on some minor toast he followed the perfervid oratory of senators, generals and league notables with devastating effect, has become a tradition. The secret of his influence with the soldiers lay in a keen sense of humour, wide and understanding tolerance, and an unaffected love for his fellow man.

The Second World War found McCallum with two men's work to do; but by giving up his Sunday morning golf he did service for the Volunteer Defence Corps in the Australian Capital Territory that is not forgotten.

To return to his civil life: "It was consistent with his character", writes Dr. Baldwin, "that his inclination lay toward some form of public service, and with this goal in view he devoted his whole time in 1920 to post-graduate study, and obtained the Melbourne University diploma of public health." On the invitation of Dr. J. H. L. Cumpston, then Director of Quarantine, he joined the Commonwealth Public Health Service. Of his work therein until his appointment in 1945 as Director-General, Dr. Cumpston writes:

> McCallum joined the Commonwealth Health Department in 1920 and served continuously with that department till his last illness.
>
> In 1921-1922 he was medical officer in the Queensland division of the department and took a very active part in the control of bubonic plague, an outbreak of which occurred at that time.
>
> In 1922 the Rockefeller Foundation in the United States of America had offered to the department some scholarships to young medical graduates of distinction for a year's training in the United States and Great Britain. McCallum was selected from a large number of applicants for appointment to one of these scholarships and proceeded for special training—public health and epidemiology at Johns Hopkins University, Baltimore, and at the London School of Tropical Medicine. He was absent from Australia, gaining this experience, for about eighteen months, and secured (with "distinction") the valued Diploma of Tropical Medicine and Hygiene of the London School. He had thus gained an exceptional experience in public health administration and tropical diseases in the two countries in which the study of these subjects was most advanced.
>
> In 1929 he was appointed to be the Department of Health's representative in the High Commissioner's office in London, and there organized on a very efficient basis all the medical aspects of migration. He was also the Australian representative on the Committee of the International Office of Public Health in Paris, and at the sessions of the Committee of the Health Organization of the League of Nations.
>
> From the time of his return to Australia in 1932 he became one of the senior members of the Department of Health and willingly accepted a steadily widening responsibility. International relations including quarantine, epidemiology, nutrition, Pacific relations, were all part of his departmental activities; but these were the formal part of his functions. Actually his advice and guidance were sought by every member of the staff and his balanced judgement and wide experience were always made available without reservation or restraint.
>
> The last major function he discharged before succeeding to the position of Director-General was to act as deputy chairman of the Medical Survey Committee appointed by the Parliamentary Committee on Social Security. When the time came for the selection of a successor to the position of Director-General of Health there was no person in Australia who had had the same comprehensive experience or the same full knowledge of all the problems that had been faced, and which had to be expected in the near future.

All that has been said above concerning his qualifications are facts open to the whole world to learn at any time by simple inquiry. For a few of us only was reserved the privilege of knowing, and developing an affection for, the man himself.

He was never content with superficial knowledge, but would not be satisfied till he had ferreted out real truth.

No matter what the provocation might have been, he was never other than gentle, courteous and kind. Although on occasions unpleasant departmental matters had to be discussed, he never, even in a momentary lapse, used an ungenerous or unjust expression.

He would have been by his qualifications, his experience and his character a great figure in the momentous transitionary period which social medicine is about to face. His unswerving honesty and loyalty to the highest ideals of service might well have had an important influence on the course of events.

We, who knew him and worked with him, feel a sense of loss which cannot be expressed.

Did space permit, this account of the life and death of Frank McCallum might, with profit, be given form and substance by drawing on records by men associated with him in the course of his life. It is possible only to select from notes by intimates a few of special interest.

Of McCallum's intellectual attainments, Dr. F. W. Clements, Director of the Australian Institute of Anatomy, writes:

With the passing of Frank McCallum the medical officers of the Commonwealth Department of Health have lost not only their recently appointed Director-General, but one who was ever ready to discuss their problems, be they official or personal. Frank McCallum had graduated to the post of Director-General "from the ranks" and was thus aware of and in sympathy with the fears, hopes and aspirations of the most junior medical officer.

His training had covered almost all branches of the department's wide range of activities, and whilst he faithfully discharged whatever were the duties of the position he held at any time, his particular and personal interests were with the scientific activities of the department. During the years he spent abroad he devoted a great deal of time to the study of scientific methods as applied to the problems of public health administration, and if he could have followed his own inclinations he would have been happy in a career in that branch of the department's activities.

From 1922 to 1929, alone or in collaboration with Dr. J. H. L. Cumpston, he made considerable contributions to our knowledge of the epidemiology of disease in Australia. His writings included international hygiene, an epidemiological report on an outbreak of smallpox on shipboard, the history of intestinal infections in Australia, the history of smallpox in Australia (the last three in collaboration with Dr. J. H. L. Cumpston).

His experience in the wider international fields of public health and his personal inclinations towards the scientific problems of public health work enabled him to discuss with sympathetic and constructive advice the problems which worried those of us engaged in research work. In this particular field his loss will be irreplaceable and we all feel we have lost a "guide, philosopher and friend".

McCallum's adventures (to him all life was adventure) in company with his friend Dr. Alec Baldwin in America and England on the Rockefeller Foundation Scholarship in 1922 deserve more space than can be given. Landing in California, he there studied "alastrim" and tick fever, and subsequently joined the Johns Hopkins University, Baltimore. There he entered on a full course in epidemiology, immunology, biochemistry and public health administration under such men as Frost, Carrel, Bull, Raymond Pearl and Welch. "In a class of nearly 100 scholarship winners from all nations his personality and charm made him a prominent member of the group. An incident is perhaps worthy of mention. It was pointed out to him that it would be easy for him to obtain the university degree of A.B. and could place the letters after his name. His response—typical—was that those who knew what the letters meant would regard him no more highly, and that it was not fair to deceive those who did not." After this period of formal study he visited the Southern States to study hookworm and malaria, and New York. In April, 1923, he joined the London School of Tropical Medicine, was placed third in the class lists, and (as already noted) obtained the D.T.M. and H. of the Royal College of Physicians.

Concerning the Medical Survey Committee on Social Security, Dr. Alan B. Lilley, the chairman, writes that McCallum entered into his work with the greatest enthusiasm and never spared himself with the short time at his disposal to make a success of the task which he had been set.

Of his tragically brief tenure of the position of Director-General of Health in the "new era" of medicine that is now upon us, for which he was so supremely well fitted, little needs to be said. From his predecessor he inherited a service of public health second to none in the world, and of which in the widest and most intimate sense he was "part and parcel", popular alike in the service and with the general medical profession. He had already, in Dr. Cumpston's absence in India, seen through various important conferences, as of the National Health and Medical Research Council.

But it was not to be; and there remains only to appreciate his character, and to give a few details concerning his death which are relevant to this note and necessary to an understanding of what he stood for in our community.

His married life was brief and its ending tragic. He married in 1926 Miss Kate Ann Hosking, of Cardiff in Wales, who died in 1930; they had no children. Dr. Baldwin writes:

He carried on with his work cheerfully, despite domestic sorrow and constant ill health. He took these so much as a matter of course that few people realized the burden he was carrying. People meeting him quickly realized that here was someone they could trust. It was this transparent honesty no doubt that made him so popular with children and dogs. Children were persons to him, not merely small fry, and they gave him their confidence and love.

Few pleasures gave him such joy as a warm sun, an Australian landscape with the sea in the background and the presence of a friend.

It is not generally known that he was highly skilled with pen and pencil. Alone or in collaboration he was responsible for important service publications on the history of plague, smallpox and intestinal infections in Australia, but it was when he wielded a lighter pen that his work was so delightful. He edited *The Speculum*, the journal of the Melbourne medical students. Getting a letter from him was an event like a breath of fresh air, with vivid word-pictures, and occasionally illustrated by thumb-nail sketches in the margin.

To have achieved a good success in life and maintained a front steadfast and serene under handicap of distressing and menacing physical disability has always commanded men's admiration and respect. Against such a handicap Frank McCallum battled during the most strenuous years of his life.

The illness which brought about his death was the culmination of many years of struggle against infective assaults associated with lithiasis which culminated in a spinal osteomyelitis and almost complete paraplegia. There began an eight months battle in which it is difficult the more to admire the fortitude and faith of the patient or the skill and devotion of all attending him. But the old trouble struck again, and against lowered resistance defied all treatment. McCallum looked at death, as he did life, in the face, blithely and without fear—he was winner, whatever befell.

Of many men, probably of most in this overcrowded and blatantly competitive world, the trite and unattractive epigram which affirms that there is no one "who can't be done without" or "whose place can't be filled" is, broadly speaking, true, and its cynical implications—the modern spirit of "debunk"—can be accepted without serious demur. Indeed, the present-day prolongation of life, with its many unhappy concomitants, suggests (as lately we have been reminded) a constructive, perhaps even a salutary significance to the saying. Nevertheless, the immediate reaction of regret and resentment for life cut off with possibilities, promises, reward of achievement and striving unfulfilled, unfinished, is proper as it is natural; not fully to be mollified by deference to a Divine will nor assuaged by thought on time's kindly healing. Milton, in his lament for Lycidas, speaks for us all. The universal grief and anxiety when Roosevelt died have been justified by events; Abraham Lincoln, Louis Botha and George Lambert left behind tasks which only they could fulfil.

No, there are some whose place cannot fully be filled. Frank McCallum's untimely death does indeed leave us and Australia sadly the poorer. He will be replaced, and perhaps his place filled with greater brilliance, but not without some loss of things that we prize greately, the human attributes of a steadfast and lovable character.

XUM

And our best tribute to him will be to face this fact squarely, and to meet it faithfully—to enshrine his memory where time cannot touch it, and with a like courage and faith in our fellowmen, a like spirit of joyous adventure in service, a like "devotion to duty", do what in us lies to ensure that the seed he sowed, of high ideals and happiness in public service, shall not fall by the wayside, nor yet on stony ground.

Nominations and Elections.

THE undermentioned have been elected as members of the New South Wales Branch of the British Medical Association:

Abramovich, Hyman, M.B., B.S., 1934 (Univ. Sydney), 110, Wiley Avenue, Wiley Park.
Cerexhe, Francis Gordon Archer, M.B., B.S., 1945 (Univ. Sydney), Box 2954, G.P.O., Sydney.
Clarke, Frederick George Joseph, M.B., 1943 (Univ. Sydney), Marlborough Hall, Roslyn Avenue, Roslyn Gardens.
Findlater, James Hilton, M.B., B.S., 1942 (Univ. Sydney), 4, Toongarah Road, Waverton.
Gray, John Benjamin, provisional registration, 1946 (Univ. Sydney), Marrickville District Hospital, Marrickville.
Hart, Henry Ellard, M.B., B.S., 1944 (Univ. Sydney), 139, Arden Street, Coogee.
Hume, Patrick Huon, M.B., B.S., 1945 (Univ. Sydney), 26, Woonona Avenue, Wahroonga.
Jack, Ian Bruce, M.B., B.S., 1941 (Univ. Sydney), 336, Beamish Street, Campsie.
Judd, Lemuel Henry, M.B., B.S., 1943 (Univ. Sydney), 54, Bent Street, Wagga.
Lafferty, Kevin Ambrose, M.B., B.S., 1946 (Univ. Sydney), St. Vincent's Hospital, Darlinghurst.
Lake, Max Emory, provisional registration, 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Morris, William Leighton, M.B., B.S., 1943 (Univ. Sydney), 50, Arnold Street, Killara.
Neild, William Henry, M.B., B.S., 1936 (Univ. Sydney), A.M.P. Chambers, 55, Hunter Street, Newcastle.
Oakey, John Stuckey, provisional registration, 1946 (Univ. Sydney), Base Hospital, Wagga.

Notice.

THE president of the Australian and New Zealand Association of Radiologists announces that Dr. Harold J. Ham will deliver a lecture on atomic physics in relation to medicine at the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, on December 6, 1946, at 8.15 o'clock p.m. Members of the British Medical Association are invited to be present.

Corrigendum.

IN the special art supplement published in the issue of November 16, 1946, in connexion with an article on varicose veins by Dr. C. H. Wickham Lawes an error has occurred in the numbering of the illustrations. Figure III should be numbered Figure XIV and *vice versa*.

Books Received.

"Penicillin in General Practice", by J. L. Hamilton-Paterson, M.D.; 1946. New York, Toronto: Staples Press Limited; London: John Bale Medical Publications Limited. 6¼" × 4", pp. 96, with illustrations. Price: 5s.

"Directory of Guy's Men: Medical and Dental"; Nineteenth Issue: 1946. London: Ash and Company Limited. 8¼" × 5¼", pp. 200. Price: 5s.

"Proceedings: Conference on Diagnosis in Sterility", sponsored by the National Committee on Maternal Health, January 26-27, 1945, New York City; Edited by Earl T. Engle; 1946. Springfield, Illinois: Charles C. Thomas. 9" × 5¾", pp. 250, with illustrations. Price: $5.00.

"Medical Biochemistry", by Mark R. Everett, Ph.D.; Second Edition; 1946. New York, London: Paul B. Hoeber Incorporated. 9¼" × 6¼", pp. 782. Price: $7.00.

Diary for the Month.

Nov. 26.—New South Wales Branch, B.M.A.: Ethics Committee.
Nov. 27.—Victorian Branch, B.M.A.: Council Meeting.
Nov. 28.—South Australian Branch, B.M.A.: Council Meeting.
Nov. 28.—New South Wales Branch, B.M.A.: Branch Meeting.
Dec. 3.—New South Wales Branch, B.M.A.: Organization and Science Committee.
Dec. 4.—Victorian Branch, B.M.A.: Branch Meeting.
Dec. 4.—Victorian Branch, B.M.A.: Council Meeting.
Dec. 4.—Western Australian Branch, B.M.A.: Council Meeting.
Dec. 5.—New South Wales Branch, B.M.A.: Special Groups Committee.
Dec. 9.—Victorian Branch, B.M.A.: Executive Committee.
Dec. 10.—Tasmanian Branch, B.M.A.: Ordinary Meeting.
Dec. 10.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
Dec. 11.—Victorian Branch, B.M.A.: Council Meeting.
Dec. 12.—New South Wales Branch, B.M.A.: Branch Meeting.
Dec. 12.—South Australian Branch, B.M.A.: Council Meeting.
Dec. 12.—Queensland Branch, B.M.A.: Annual Meeting.
Dec. 17.—New South Wales Branch, B.M.A.: Medical Politics Committee.
Dec. 17.—New South Wales Branch, B.M.A.: Ethics Committee.
Dec. 20.—Queensland Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

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